EFFECTIVENESS OF A CULTURALLY ADAPTED MASS MEDIA CAMPAIGN IN PROMOTING AWARENESS OF COLORECTAL CANCER IN A SEMI URBAN MALAYSIAN SETTING

DARISHIANI PARAMASIVAM

FACULTY OF MEDICINE
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THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPY

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Name of Candidate: **Darishiani Paramasivam**

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EFFECTIVENESS A CULTURALLY ADAPTED MASS MEDIA CAMPAIGN IN PROMOTING AWRENESS OF COLORECTAL CANCER IN A SEMI URBAN MALAYSIAN SETTING

ABSTRACT

Colorectal cancer (CRC) is the most common cancer among men and the second most common among women in Malaysia. A delay in its detection and presentation to healthcare increases morbidity and reduces survival rates. The late-stage diagnosis is partly due to the lack of awareness and poor knowledge of the symptoms of CRC. Previously conducted CRC awareness campaigns in Malaysia were short (usually one day) and lacked proper evaluation. The lack of a culturally adapted mass-media intervention with an evaluation framework in Malaysia has caused a knowledge gap in the strategies to raise CRC awareness. This study aims to develop, validate, implement, and evaluate an evidence-based colorectal cancer awareness-raising mass-media campaign that is culturally acceptable for Malaysians. The mass-media campaign was culturally adapted from the 'Be Cancer Aware Campaign (Northern Ireland)' to suit the Malaysian culture. The developed and validated CRC mass-media campaign was named 'Be Cancer Alert – Colorectal Cancer' (BCAC-CRC) and was implemented in March 2018. A systematic review was conducted to assess symptom awareness and barriers to screening for CRC. A mass-media campaign was culturally developed and validated using a Heuristic Framework. Heuristic Framework has five adaptation stages consisting of (a) information gathering, (b) preliminary adaptation design, (c) preliminary adaptation tests, (d) adaptation refinement, and (e) adaptation trial. The reach and factors associated with the recognition of culturally adapted BCAC-CRC were evaluated. The impact of the BCAC-CRC on awareness-raising (knowledge, attitude, and beliefs) about colorectal cancer and screening (belief and experience) among the community in Rawang, Selangor, was evaluated by conducting a pre- and post-household survey on the same set of

respondents. The results of the systematic review indicate a notable deficiency in awareness and comprehension of the early symptoms of CRC and the barriers to CRC screening. A total of 956 respondents were recruited during the pre-campaign and 730 respondents during the post-campaign household survey. The BCAC-CRC reached the communities in Rawang through television advertisements (42.9%) and printed materials (40.0%), the most commonly recognised media. The campaign significantly increased the proportion of participants' knowledge of each CRC symptom and risk factor. In addition, it also significantly reduced the proportion of participants for all the negative beliefs. After the campaign, the total score of knowledge improved (β= 2.290, CI= 1.806, 2.773), negative beliefs about CRC and CRC screening were reduced (β= -0.689, CI= -0.896, -0.482) and minimally improved attitude in help-seeking behaviour (β= 0.238, CI= 0.094, -0.383). Based on the findings of this study, the adapted, developed, and validated CRC mass-media campaign was found to be a culturally acceptable, appropriate, and reliable campaign among the populations from different ethnic groups in Rawang. In addition, the campaign has effectively improved awareness (knowledge and beliefs) about CRC and screening (belief and experience) with minimal improvement in attitude towards help-seeking behaviour among the Rawang population. Future mass-media campaigns should be implemented and evaluated during a longer period, specifically targeting help-seeking behaviour for any CRC symptoms.

Keywords: Colorectal Cancer, Colorectal Cancer Awareness, Cultural Adaptation, Mass-media campaign

KEBERKESANAN KEMPEN MEDIA MASSA YANG DISESUAIKAN DENGAN BUDAYA DALAM MEMPROMOSIKAN KANSER KOLOREKTAL DALAM SETING SEMI PERBANDARAN MALAYSIA

ABSTRAK

Kanser Kolorektal (CRC) adalah kanser yang utama kebiasaannya berlaku dalam kalangan lelaki dan yang kedua dalam kalangan wanita di Malaysia. Kelewatan dalam pengesanan dan penyerahan kepada pengamal kesihatan meningkatkan morbiditi dan mengurangkan kadar kelangsungan hidup. Diagnosis peringkat akhir sebahagiannya disebabkan oleh kurangnya kesedaran dan pengetahuan mengenai gejala CRC. Sebelum ini, kempen kesedaran CRC yang dijalankan di Malaysia adalah dalam tempoh yang singkat (biasanya satu hari) dan tidak mempunyai penilaian yang sewajarnya. Kekurangan campur tangan media massa yang disesuaikan dengan budaya dengan rangka kerja penilaian di Malaysia telah menyebabkan jurang pengetahuan dalam strategi untuk meningkatkan kesedaran CRC. Kajian ini bertujuan untuk membangun, mengesahkan, melaksanakan, dan menilai kempen kesedaran kanser kolorektal berasaskan bukti yang boleh diterima secara budaya bagi rakyat Malaysia. Kempen media massa disesuaikan secara budaya daripada 'Be Cancer Alert – Colorectal Cancer' (BCAC-CRC) dan telah dilaksanakan pada Mac 2018. Satu ulasan sistematik telah dijalankan untuk menilai kesedaran gejala dan halangan untuk saringan CRC. Kempen media massa telah dibangunkan mengikut budaya dan disahkan menggunakan Rangka Kerja Heuristik. Rangka Kerja Heuristik mempunyai lima peringkat penyesuaian yang terdiri daripada (a) pengumpulan maklumat, (b) reka bentuk penyesuaian awal, (c) ujian penyesuaian awal, (d) penambahbaikan penyesuaian, dan (e) percubaan penyesuaian. Jangkauan dan faktor-faktor yang berkaitan dengan pengiktirafan BCAC-CRC yang disesuaikan dengan budaya telah dinilai. Kesan BCAC-CRC terhadap peningkatan kesedaran (pengetahuan, sikap, dan kepercayaan) mengenai kanser kolorektal dan saringan (kepercayaan dan

pengalaman) dalam kalangan masyarakat di Rawang, Selangor, telah dinilai dengan menjalankan kaji selidik pra dan pasca isi rumah pada set responden yang sama. Keputusan ulasan sistematik menunjukkan kekurangan ketara dalam kesedaran dan pemahaman gejala awal CRC dan halangan untuk pemeriksaan CRC. Seramai 956 responden menyertai pra-kempen dan 730 responden telah melengkapkan tinjauan isi rumah semasa pasca kempen. BCAC-CRC mendapatkan komuniti di Rawang melalui pendekatan iklan televisyen (42.9%) dan bahan bercetak (40.0%), media yang paling biasa diiktiraf. Kempen ini meningkatkan dengan ketara pengetahuan peserta mengenai setiap gejala CRC dan faktor risiko. Di samping itu, ia juga mengurangkan kadar peserta untuk semua kepercayaan negatif. Selepas kempen, jumlah skor pengetahuan bertambah baik (β= 2.290, CI= 1.806, 2.773), skor kepercayaan negatif mengenai saringan CRC dan CRC mengurang sedikit (β= -0.689, CI= -0.896, -0.482) dan skor sikap yang lebih baik dalam tingkah laku mencari bantuan bertambah sedikit (β= 0.238, CI= 0.094, -0.383). Berdasarkan penemuan kajian ini, kempen media massa CRC yang disesuaikan, dibangunkan dan disahkan didapati sebagai kempen budaya yang boleh diterima, sesuai, dan boleh dipercayai dalam kalangan penduduk dari kumpulan etnik yang berbeza di Rawang. Di samping itu, kempen ini telah meningkatkan kesedaran (pengetahuan dan kepercayaan) mengenai CRC dan saringan (kepercayaan dan pengalaman) dengan peningkatan sikap yang minimum terhadap tingkah laku mencari bantuan dalam kalangan penduduk di Rawang. Kempen media massa untuk masa depan perlu dilaksanakan dan dinilai dalam tempoh yang lebih panjang, khususnya menyasarkan tingkah laku mencari bantuan untuk sebarang gejala CRC.

Kata Kunci: Kanser Kolorektal, Kesedaran Kanser Kolorektal, Penyesuaian Budaya, Kempen Media Massa

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LIST OF SYMBOLS AND ABBREVIATIONS

ACS	American Cancer Society
AJCC	American Joint Committee on Cancer
APC	Adenomatous Polyposis Coli
ASR	Age-Standardized Rate
BCA	Be Cancer Aware Campaign
BCAC-CRC	Be Cancer Alert Campaign – Colorectal cancer
BCOC	Be Clear on Cancer Campaign
BeCAP	Be Cancer Aware Programme
BMI	Body mass index
CUP	Continuous Update Project
CRC	Colorectal cancer
CT	Computed Tomography
DOSM	Department of Statistics Malaysia
EPD	Expert Panel Discussion
FAP	Familial Adenomatous Polyposis Syndrome
FIT	Fecal Immunochemical Tests
FS	Flexible Sigmoidoscopy
GD	Group Discussion
GEE	Generalized Estimating Equations
GLM	Generalized Linear Model
GLOBOCAN	Global Cancer Observatory
GP	General practitioner
HDI	Human Development Index

iFOBT	Immunochemical Fecal Occult Blood Test
IBD	Inflammatory Bowel Diseases
MNCR	Malaysia National Cancer Registry
MOH	Ministry of Health, Malaysia
MySCan	Malaysian Study on Cancer Survival
NCRAS	National Cancer Registration and Analysis Service
NCD	Noncommunicable disease
NGO	Non-governmental organizations
PHA, NI	Public Health Agency Northern Ireland
T2DM	Type 2 diabetes mellitus
TNM	Tumor-Lymph Node-Metastasis
WC	Waist Circumference
WCRF	World Cancer Research Fund
WHO	World Health Organization

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1 Introduction of this Chapter

This chapter commences with a concise background of Colorectal cancer, an examination of the impact of CRC in Malaysia, and the research problem statement. It further delves into the understanding of symptom awareness and attitudes towards CRC as well as obstacles to CRC screening among Malaysians. Moreover, this section identifies areas lacking in research, formulates research inquiries, proposes hypotheses, justifies the need for conducting the study, sets out objectives, asserts the relevance of this research project and outlines the thesis structure. Lastly, the chapter ends with a recap summarising its key points.

1.2 Candidature's Role in this study

The candidate has been involved in the Be Cancer Alert Colorectal Cancer Campaign research project since its commencement in 2018. As part of the study's intervention, the candidate played a role in adapting and developing the BCA-CRC campaign to fit with different cultures. This involvement included contributing to all aspects of cultural adaptation, design, and execution of the BCA-CRC campaign. The candidate actively engaged in and contributed to media events for launching the BCAC-CRC campaign, as well as distributing printed materials such as posters, brochures, roll-up posters, and banners alongside community programmes within Gombak District (Rawang and Kuang).

Furthermore, the individual actively participated in gathering data before and after the intervention in the Gombak district in 2018. They are affiliated with the Centre for Population Health, Department of Social Preventive Medicine, where they were involved in organising and participating in data collection and management alongside a research

team during this project. Their responsibilities included managing data through entry, verification, and cleansing processes. Additionally, they initiated data analysis under supervision from their mentors and presented the study's outcomes in their thesis. This project received funding from Newton Ungku Omar Funding, the Medical Research Council, and Akademi Sains Malaysia (MR/P013910/1).

1.3 Global Burden of Colorectal Cancer

Noncommunicable diseases (NCDs) currently contribute to the majority of worldwide mortality and are a severe public health threat (World Health Organization, 2020). Therefore, cancer was the second leading cause of mortality; almost one in six deaths was related to cancer (World Health Organization, 2020). The incidence and mortality of cancer are increasing rapidly across the world. According to the GLOBOCAN 2020 report, an estimated 19.3 million new cancer incidents and 10.0 million cancer-related deaths occurred worldwide in 2020 (World Health Organization, 2020). According to the World Health Organisation (WHO), approximately 70% of deaths from cancer occur in low- and middle-income countries (Bray et al., 2018). Globally, colorectal cancer (CRC) is the third most commonly diagnosed cancer (10.0%) and the second leading cause of cancer death (9.4%) in 2020 (World Health Organization, 2020).

CRC occurrence and mortality rates vary by gender and geographical region (World Health Organization, 2020). According to the Global Cancer Observatory (GLOBOCAN) 2020 report, the highest age-standardised CRC incidence is 45.3 per 100,000 individuals in Hungary, and the lowest is 3.3 per 100,000 individuals in Guinea (World Health Organization, 2020). In addition, high-income countries contribute more than half of all CRC incidences. In particular, the incidence rates of CRC in countries with a very high human development index (HDI) are approximately four times higher than in nations with a low HDI. According to various research studies, this trend is also influenced by

environmental factors, which include a more sedentary lifestyle, abnormal body weight (obesity), consumption of highly processed foods, alcohol, and red meat, along with an increase in life expectancy (Sawicki et al., 2021). Therefore, CRC is related to lifestyle diseases that can be prevented by understanding the early symptoms of CRC and early detection.

Poor health literacy and a lack of awareness about symptoms are major contributing factors to the prolonged delay in the detection of CRC (Ahmed et al., 2021; World Health Organization, 2020). Significant barriers to seeking a healthcare professional's advice include psychosocial issues such as stigma associated with cancer, fear, hiding symptoms or avoiding the doctor, and lack of confidence in interpreting symptoms (Oberoi et al., 2016). Two studies conducted in Jordan and China, respectively, mentioned the primary reasons for the delay in the presentation were a lack of understanding that symptoms were suggestive of cancer diagnosis, poor health literacy, or a reluctance to consult a doctor (Abu-Helalah et al., 2016; Jin et al., 2022).

1.4 Malaysia Burden of Colorectal Cancer

Malaysia is not a notable exception to the escalating CRC incidence that constitutes a significant public health issue in the Asia-Pacific region. According to the latest Malaysia National Cancer Registry (MNCR), the incidence of CRC increased by 11.74% from 13,693 to 15,515 between the years 2007 – 2011 (Zainal Ariffin & Nor Saleha, 2011) to the years 2012 – 2016 (Azizah AM., 2019). Besides, males have a lifetime risk of 1 in 56 compared with 1 in 20 for females, and incidence rates are substantially higher in socioeconomically deprived groups. Although lifetime risk is reported to be higher in females, incidence rates of CRC are found to be higher in men (16.9%) compared to women (10.7%). In both males and females, the incidence rates of CRC were more common in Chinese, followed by Malay and Indian (Azizah AM., 2019). Even though

CRC can be found early through screening, more than 65% of CRC cancer patients in Malaysia were diagnosed with stage III or IV cancer.

Colorectal cancer is a cancer that is largely preventable and treatable if diagnosed early. As reported by the Malaysian Study on Cancer Survival (MySCan), CRC has a 5-year relative survival (RS) of 51.1% (National Cancer Institute, 2018). In comparison to stage IV (17.3%), phase I has the highest RS (75.8%) (National Cancer Institute, 2018). As early diagnosis can minimise morbidity and increase survival rate, the Cancer Unit of the Ministry of Health (MOH) organised a National Colorectal Cancer Screening Programme in 2014 to encourage the use of iFOBT as an early screening method for CRC (Ministry of Health, 2014). The MOH confirmed that iFOBT could be utilised as a screening method in Malaysia after conducting a health technology assessment in 2011 (Ministry of Health Malaysia, 2011). A 30-year follow-up study of iFOBT screening as an early screening found that it decreased long-term mortality (five-year follow-up mortality) by 32% annually and 18% for biannual screening (Zauber, 2015). Even though screening and early detection are essential for survival, a population-based screening programme for CRC has yet to be widely implemented. Only a few average-risk individuals in Malaysia are willing to participate in the CRC screening program (Hilmi et al., 2010a; Syed Soffian et al., 2021).

1.5 Awareness of Risk Factors and Symptoms of Colorectal Cancer (CRC) Among Malaysian

CRC awareness refers to the efforts to educate the public about CRC, its symptoms, and risk factors. Awareness of the risk factors and symptoms of CRC plays a vital role in promoting early detection, improving treatment outcomes, and ultimately reducing the impact of this disease on individuals and communities. Besides increasing awareness, more people can take proactive steps to reduce their risk or detect the disease at an earlier,

more treatable stage. The primary outcome of CRC awareness campaigns is increasing awareness and understanding of the disease (symptoms and risk factors), leading to early detection and better treatment outcomes. An awareness campaign combining efforts from various stakeholders can effectively promote CRC awareness, leading to earlier detection, better treatment outcomes, and improved support for individuals affected by the disease.

The awareness of CRC among Malaysians still seems very low and insufficient. This low awareness was demonstrated through a few research studies conducted in Malaysia for the past few years (Loh, 2013; Sindhu et al., 2019; Su et al., 2013b; Tze et al., 2016). On average, participants recalled less than one symptom associated with CRC despite 'abdominal pain' being the most widely identified symptom (14.5%). In addition, a study conducted in Perak found that 74% of participants who lived in rural areas could not identify any CRC symptom without prompting (Su et al., 2013a).

According to Hashim et al., 60% of patients who experienced rectal bleeding delayed seeking medical attention. This is because patients were unaware of the cause of their rectal bleeding. However, a quarter of the patients believed haemorrhoid caused it, but only two patients identified cancer as a potential cause. Therefore, only two patients in the study suspected they had CRC (Hashim et al., 2010).

Awareness of unprompted risk factors associated with CRC was poor, as 66.2% of participants failed to list any risk factors related to CRC, including an average of less than one risk factor. Alcohol intake was the most frequently mentioned risk factor by participants (10.8%), followed by a family history of colon cancer (9.2%) and physical inactivity (8.8%) (Sindhu et al., 2019). Based on data from 14 studies, researchers concluded that people with diabetes have a 38% higher risk of developing CRC than those without the disease. However, the suburban populations of Sabak Bernam and Kuala Selangor were the least likely to be aware that 'having diabetes' is a risk factor related to CRC (Karikalan et al., 2021).

The most significant variables influencing an individual's CRC detection or screening delay are CRC symptoms and risk factor knowledge. This is believed to be a prerequisite for behavioural change because it affects the understanding of CRC symptoms and risk factors. As a result, Malaysians must be aware of the symptoms and risk factors for CRC. In order to achieve this, it is crucial to educate individuals about modifiable risk factors and early disease symptoms through educational campaigns.

1.6 Attitude and Belief towards CRC and CRC Screening

Studies in Malaysia have demonstrated that lower socioeconomic class was significantly associated with late and more advanced-stage cancer diagnosis, as well as poorer cancer survival rates (Kong et al., 2010). A recent study discovered that a shortage of awareness and negative beliefs about cancer might elevate cancer incidence and mortality rates among Appalachian populations (Vanderpool et al., 2019). For example, more than 30% did not believe that cancer could be cured; perhaps more worrying is that 65% thought that most cancer treatments were worse than the disease of cancer (Su, 2015). Other examples are, two systematic reviews (Macdonald et al., 2006; Ramirez et al., 1999) showed that lack of awareness of cancer symptoms was one of the critical factors for patient-related delay in diagnosis. In addition, several other studies identified poor awareness as well as negative attitudes and beliefs about cancer as contributing factors to low uptake in several cancer screening programmes (Aniebue & Aniebue, 2010; Early et al., 2011; Gursoy et al., 2011). Shreds of evidence demonstrated that the conduct of cancer control activities would significantly impact improvements in poor awareness, negative attitudes, and beliefs about cancer.

In a Malaysian study, 32.1% of participants erroneously felt that the barriers to CRC screening reflected a lack of interest in screening due to a fear of cancer (R. A. Al-Naggar et al., 2015). Similarly, another study conducted with 1905 moderate risk patients of West

Malaysia indicates that 96.7% had a negative attitude towards screening practice. This is linked to participants' beliefs that CRC screening is embarrassing, uncomfortable, complicated, and painful (Bujang et al., 2021; Harmy et al., 2011b). Besides, this demonstrates their lack of awareness about CRC screening reflects a poor attitude towards CRC screening (R. A. Al-Naggar et al., 2015; Bujang et al., 2021). CRC screening not only aids in early diagnosis but can also help minimise the cost of the patient's treatment and increase the patient's quality of life (Dan et al., 2012). These highlight the need for early CRC diagnosis, as most patients are detected later in the disease. If individuals are diagnosed with CRC in its early stages, there is a possibility of treatment. Therefore, an awareness campaign should aim to motivate and inspire people to promptly seek medical help or consult healthcare professionals upon noticing any symptoms related to colorectal cancer.

1.7 Intervention to Increase Cancer Awareness

Public health interventions in the form of cancer awareness-raising programmes have been developed and implemented in order to improve early presentation, diagnosis, and improve survival rates. For example, Public Health England and Public Health Agency Northern Ireland established and implemented the "Be Clear on Cancer" (BCOC) programme in England in 2011 and the "Be Cancer Aware Programme" (BeCAP) in Northern Ireland in 2014 (Lai et al., 2021; PHA, 2015a). The National Cancer Registration and Analysis Service (NCRAS), part of Public Health England and Public Health Agency Northern Ireland, conducted the analyses for these campaigns (Lai et al., 2021; PHA, 2015b). The results of these initiatives showed a heightened understanding of cancer symptoms and an increase in patients visiting GP practices after experiencing campaign-related critical symptoms. Furthermore, there was a rise in urgent cancer referrals by primary care doctors in areas where the intervention took place. This was

coupled with increased disease diagnostic and treatment activities, along with a tendency towards diagnosing the disease at an earlier stage (Ironmonger et al., 2015; J. Moffat et al., 2015; Power & Wardle, 2015).

There is a need to create and assess the implementation of a cancer awareness-raising intervention or programme that is culturally relevant and aimed at boosting cancer awareness and behaviour modification. This will increase cancer screening participation, timely health-seeking behaviours, early diagnosis, and a positive change in beliefs towards cancer and cancer screening. In particular, an adequate theoretical or conceptual foundation is required that links public health intervention programme content, socio-cultural context, population need, and best available evidence to achieve successful implementation outcomes (Burgess et al., 2008; Davidson et al., 2013). Intervention and programme development need to be transparent, well documented, and reported, as well as culturally acceptable, replicable, and amenable to rigorous evaluation.

Previous awareness-raising campaigns in Malaysia were sporadic, fragmented, and organised by individual agencies, NGOs, and other bodies. Moreover, those awareness-raising campaigns were not evaluated, and there was no evidence of whether those campaigns increased the public's awareness of cancer (Loh et al., 2017). This demonstrates the necessity for a well-coordinated, extensive public cancer awareness initiative targeting a large population. The main aim of this research is to create a culturally tailored mass-media campaign to raise awareness about colorectal cancer and assess its effectiveness across different ethnic, socioeconomic, and educational demographics in the chosen region of Malaysia.

1.8 Research Gap

Be Cancer Alert (BCAC) is the first mass-media campaign in Malaysia to educate the public about colorectal cancer and screening programmes. The campaign has been

evaluated using a rigorous evaluation framework. Although a few CRC awareness campaigns have been held in Malaysia before, they were generally conducted in a short period (mostly a day), and their efficacy was never assessed. In Malaysia, there is a gap in knowledge about the most effective strategy for increasing awareness of CRC symptoms and CRC screening due to a lack of culturally appropriate mass-media intervention with an evaluation framework. Thus, this research aimed to assess the efficacy of the BCAC-CRC mass-media campaign, which was culturally adapted and carried out for five weeks.

The BCAC-CRC mass-media initiative was combined with a printed media campaign at the local level in the Gombak district, along with a nationwide campaign through television, radio, website, and social media. In Malaysia, it was not feasible to find a comparable location that had not been exposed to the public mass-media campaign as a control group. Therefore, conducting a pre- and post-intervention study (without a control group) would be the most effective way to evaluate the effectiveness of BCAC-CRC. Additionally, having measurement tools available in both English and Malay languages is also crucial.

1.9 Justification of the study

Previous cancer awareness campaign conducted by some groups of non-government organisation in Malaysia primarily focused on a single state and a specific type of cancer, with inadequate emphasis on symptom awareness. A lack of awareness about primary cancer symptoms may delay help-seeking, diagnosis, and treatment, leading to poor survival outcomes and low uptake of cancer screening, which tends to delay diagnosis. Furthermore, a cancer awareness-raising mass-media campaign has been proven effective in improving cancer-related awareness and uptake in cancer screening (Myers et al., 1994; Tong et al., 2000).

It is worrying that elder individuals in Perak, Malaysia, have lower levels of awareness of CRC symptoms, despite the fact that the risk of developing cancer increases with age. (Loh et al., 2013; Su et al., 2013a). One of the most common reasons given by cancer patients is that they delayed seeking help because they did not realise a CRC symptom as suspicious (Chapple et al., 2004; Smith et al., 2005). According to a study in the United Kingdom reported that the anticipated delay in seeking help from healthcare professionals was strongly related to the inability to recognise early cancer symptoms and emotional barriers towards cancer screening (J. Moffat et al., 2015). It has been demonstrated that identifying early cancer symptoms is vital because it has been shown that individuals who correctly identify cancer symptoms will not delay seeking a healthcare professional's advice (J. Moffat et al., 2015).

The previous studies on the educational programme for cancer in the United States and a health promotion campaign in the United Kingdom found modest increases in knowledge, the first an increase in average cancer symptom awareness score of about 6% after eight months (Skinner et al., 2000) and the second an increase in average cancer symptom awareness score of 20% after six weeks (McCullagh et al., 2005). Therefore, this research intends to focus on designing, implementing, testing and evaluating the implementation of a culturally adapted CRC awareness-raising mass-media campaign for Malaysia. Besides that, this study also considers social inequalities and attempts to target and improve the welfare of vulnerable communities in Malaysia.

This study is not only timely but also necessary to address the growing burden of CRC in Malaysia. By focusing on culturally adapted interventions, the research aims to bridge the gap in awareness and screening practices, ultimately contributing to better health outcomes in the community. The findings will have broader implications for public health strategies in multiethnic contexts, emphasizing the importance of cultural sensitivity in health communication.

1.10 Public Health Significant

The uniqueness of this study lies in the Be Cancer Alert (BCAC) mass-media campaign, which is the first culturally adapted campaign in Malaysia to raise awareness about colorectal cancer. Colorectal cancer (CRC) remains a substantial global health concern, and raising awareness plays a pivotal role in addressing this challenge. The public health significance of this study is in its implementation and evaluation of the BCAC, which is crucial for the government, individuals, and the community.

This is vital for individuals and the community in terms of improving their knowledge, reducing negative beliefs about cancer and CRC screening, encouraging them to seek timely medical attention, understanding the importance of early screening and understand the importance of early detection. These changes will ultimately improve screening uptake, early detection and diagnosis. Early detection is key to successful treatment outcomes which will lead for a better prognosis and quality of life. Ultimately, it enhances public health by reducing the incidence and mortality of CRC.

This is crucial for the government in terms of policy implications, resource allocation, and guidance for a sustained campaign. In the future, the protocol and challenges used in this research study will educate and direct our public health researchers, MOH and NGOs in planning and conducting more sustained cancer awareness campaigns in Malaysia.

1.11 Research Questions

1. What is the awareness of CRC symptoms and barriers to CRC screening among Malaysians?

2. How to develop and culturally adapt a mass-media campaign to raise awareness about CRC in order to enhance understanding of its symptoms and increase the number of people getting screened for CRC in Malaysia?
3. What are the factors associated with the recognition of culturally adapted intervention for Be Cancer Alert- colorectal cancer campaign among the community from Rawang, Selangor?
4. What are the changes in knowledge, attitudes, and beliefs towards CRC, including CRC screening before and after CRC awareness-raising mass-media campaign at the selected area in Malaysia?

1.12 Hypothesis

Alternative hypotheses:

1. There is an association between sociodemographic characteristics, family and friends with a history of CRC, and screening history with recognition of the Be Cancer Alert- a colorectal cancer campaign.
2. There are changes in knowledge, attitudes, and beliefs towards CRC, including CRC screening before and after the CRC awareness-raising mass-media campaign.

1.13 Objectives of the Study

1.13.1 General Objectives

The study aims to design and implement a mass-media campaign for colorectal cancer as an intervention that is culturally adapted for Malaysians and to evaluate the effectiveness of the intervention on awareness-raising about colorectal cancer and screening among the community from Selangor.

1.13.2 Specific objectives

1. To conduct a systematic review to identify the awareness of colorectal cancer symptoms and barriers to colorectal cancer screening among Malaysians.
2. To develop, validate, and implement the colorectal cancer awareness mass-media campaign with adapted Malaysian culture as an intervention.
3. To determine the factors associated with the recognition of culturally adapted intervention for Be Cancer Alert- a colorectal cancer campaign among the community in Selangor.
4. To evaluate the effectiveness of the Be Cancer Alert - colorectal cancer campaign on awareness-raising (knowledge, attitude, and beliefs) about colorectal cancer and screening (belief and experience) among the community in Selangor.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction of this Chapter

This chapter will describe the systematic literature review that provides the background and context to this study. Gaps in the literature relevant to this thesis are also outlined, which provide the direction and positioning for this thesis. This chapter is divided into fifteen subsections. Subsections 2.2 to 2.3 provide a comprehensive overview of colorectal cancer and its pathophysiology, including risk factors, early detection methods, and treatment options worldwide. It is followed by subsection 2.4 describes an overview of the epidemiology of colorectal cancer worldwide and in Malaysia with a focus on incidence rates, mortality trends, and regional disparities in access to healthcare resources.

Subsequently, subsections 2.5 to 2.7 outline the knowledge of CRC, attitude, and belief towards CRC. The knowledge of CRC includes symptoms and the potential risk factors of CRC. This subsection also provides a review of awareness of CRC symptoms in Malaysia. Subsections 2.8 to 2.10 describe the general types and application of CRC screening along with CRC screening in Malaysia and barriers towards CRC screening. Subsection 2.11 provides details on the treatment and survival rate of CRC.

Subsection 2.12 highlights the various health promotions implemented to improve cancer knowledge, attitude, and belief on cancer, especially CRC, worldwide and in Malaysia. In addition, details about the "Be Cancer Aware Campaign," which was successfully conducted by the Public Health Agency from the United Kingdom, are presented in this subsection. Subsection 2.13 provides a detailed description of the cultural adaptation of health promotion intervention and explains explicitly the Heuristic Framework model for cultural adaptation. Finally, subsections 2.14 to 2.15 define the theoretical and conceptual framework using Andersen's behavioural model.

2.2 Colorectal Cancer (CRC)

CRC is a term that combines colon cancer and rectal cancer. Besides CRC, this is also called bowel, colon, or rectal cancer. Colon cancer and rectal cancer are often grouped because they have many features in common. A colon is a large intestine or large bowel; meanwhile, the rectum is the passageway that connects the colon to the anus. It is a highly specialised organ responsible for waste disposal, making it easy and comfortable to clean the intestines. The colon eliminates stubble water and stores the solid stool. It empties its contents once or twice a day into the rectum to begin the elimination phase. Cancer is the development of abnormal cell growth that occurs in the inner lining of the colon or rectum, which can invade or spread to other parts of the body. The abnormal cell growth on the inner lining of the colon or rectum is called polyps. Over several years, some polyps may turn into cancer.

2.3 Pathology of colorectal cancer

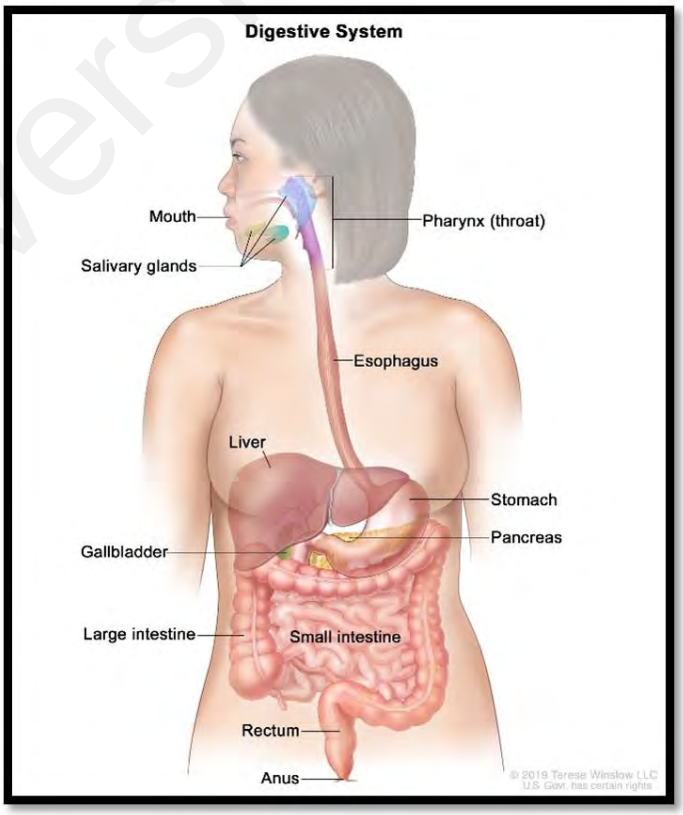

Figure 2.1: The Digestive System

As the World Health Organisation (WHO) suggested, CRC is histologically divided into several subtypes. In descending frequency, the most prevalent subtypes are adenocarcinoma, mucinous adenocarcinoma, and signet ring cell cancer. CRC is classified according to the tumour-lymph node-metastasis (TNM) staging system, which is the most widely used and was last revised in 2010 (Edge & Compton, 2010). This staging system provides information about the infiltrative growth of the primary tumor, spread to regional lymph nodes or distant organs. The TNM-staging system provides broad prognostic information and facilitates decision-making in therapy (Compton, 2007).

T stage is identified as Tx (tumour cannot be measured), T0 (no tumour evidence), and T1s (cancer cells are only detected in the superficial tissue, also known as in-situ cancer or pre-cancer). Besides, T1, T2, T3, and T4 identify the tumour according to its size and whether it has spread to surrounding tissues and structures. The American Joint Committee on Cancer (AJCC) staging handbook describes that the TNM staging system is a typically straightforward method for histological determination of tumour invasion of the submucosa (T1), muscularis propria (T2), and pericolorectal tissues via the muscularis propria (T3) (Edge & Compton, 2010). However, it may sometimes be hard to determine whether a tumour penetrates the visceral peritoneum surface (T4a) and whether tumours invade or adhere to other organs or structures (T4b).

A pathologist must examine at least 12 lymph nodes to predict the likelihood of identifying metastases. The higher the number of lymph nodes examined, the greater the chance of survival in stage II CRC (Swanson et al., 2003). When CRC is surgically removed, the distance between the tumor and the transverse margin is considered optimal at over 5 cm to avoid recurrence in the anastomosis. The interpretation of discrete tumour deposits in pericolorectal fat away from the primary tumour but without detectable residual lymph node tissue is one of the crucial issues facing nodal staging. A tumour

nodule > 3 mm was counted as a positive node in the 5th edition of the AJCC Cancer Staging Manual, while a nodule > 3 mm was categorised as a discontinuous extension (T3) type. Meanwhile, the current edition (7th edition) recognises that tumour deposits may represent discontinuous extension, venous invasion with extravascular spread, or totally replaced lymph nodes (Edge & Compton, 2010).

Several different tumour grading systems are based on architectural and cytological features. These describe the level of cell differentiation within the tumour, commonly through separation into four groups: well-differentiated (grade 1), moderately differentiated (grade 2), poorly differentiated (grade 3), and undifferentiated (grade 4). Although this grading system has been questioned, it has not reached widespread acceptance (Compton, 2007). However, high tumour grade is a prognostic unfavourable pathological factor, as are lymphatic- and vascular invasion by the tumour, absence of tumoural infiltrating lymphocytic response (Ogino et al., 2009), and venous vessel invasion (Compton, 2007).

2.4 Epidemiology of Colorectal Cancer

2.4.1 Burden, incidence, and mortality of colorectal cancer (CRC) in worldwide

CRC is the third most commonly diagnosed cancer and the second leading cause of cancer-related death worldwide, accounting for an estimated 1.93 million new CRC cases in 2020. Around 0.94 million deaths are estimated to occur in 2020 (Xi & Xu, 2021). In transitioned countries, incidence rates are approximately four times higher than in transitioning countries, although there is less fluctuation in mortality rates because fatality is more elevated in transitioning nations (Sung et al., 2021). Countries undergoing rapid societal and economic changes show rapid increases in cancer incidences, whereas, in high-income countries, the incidences are already high. Globocan 2012 reported that the incidence rate of CRC is higher in developed Asian countries such as Japan, South Korea,

and Singapore compared to Malaysia and other developing Asian countries (Ferlay J, 2012). In contrast, countries with high human development index (HDI), such as the USA, Australia, New Zealand, and several Western European countries, have reported that CRC incidence and mortality rates have steadily stabilised or decreased.

Globally, CRC is the third most common cancer among males (10.9% of cases) and the fourth leading cause of cancer deaths after lung, liver, and stomach cancer in 2018 (Bray et al., 2018). Among females, CRC is the second most frequently diagnosed cancer after breast and the third leading cause of cancer death after breast and lung cancer (9.5%). For both sexes combined, CRC was the third most frequently diagnosed cancer (10.2% of the total cases) after lung (11.6%) and breast cancer (11.6%), as well as the second leading cause of cancer death (9.2% of the total cancer deaths) after lung cancer (18.4%). The age-standardised incidence and mortality rate of CRC was about 8.7 times higher among males than females (19.9 and 11.2 per 100,000, respectively) (Bray et al., 2018).

2.4.2 Burden, incidence, and mortality of colorectal cancer (CRC) in Malaysia

In Malaysia, CRC was the second most common cancer among Malaysian males and females after lung cancer and breast cancer, respectively, in 2020. According to estimates from the Globocan 2020 database, CRC was the second most frequently diagnosed cancer, with 6, 597 newly diagnosed CRC cases, and the third leading cancer cause of death, with 3, 420 number of death (World Health Organization, 2020). In Malaysia, the rates of CRC occurrence varied between 13.2% in 2012 and 13.5% in 2017, showing a slight increase from 2007 to 2011 (Azizah AM., 2019). CRC incidence rates increased by age-standardized rate (ASR) of 0.2 cases in males and no change in females per 100,000 populations as compared with the previous five-year period (reports from 2007–2011 and 2012–2016) (Azizah AM., 2019; Zainal Ariffin & Nor Saleha, 2011). CRC incidence increases with age and has been reported highest among Chinese (ASR 19.6 cases per

100,000), followed by Malay (ASR 12.2 cases per 100,000) and Indian (ASR 11.0 cases per 100,000). Over half of CRC cases (63.7%) are detected at stages 3 and 4 (Azizah AM., 2019).

The first study in Malaysia on the estimation of incidence and mortality rate for CRC patients by sex and ethnicity was conducted by Radzi and his colleague (2016) (Hassan et al., 2016). This study investigated 4,501 cases of CRC reported in the National Cancer Patient Registry-CRC from 2008 to 2013. According to this study, the highest incidence of colorectal cancer (CRC) was reported among Chinese (27.35 per 100,000), particularly in comparison to Malay and Indian populations (18.95 and 17.55 per 100,000, respectively). Among the males, the age-standardised CRC incidence rate was around 1.33 times higher than females (24.16 and 18.14 per 100,000, respectively). Moreover, they also stated that the overall age-standardised CRC mortality rate was 1.42 times higher among males (11.46 per 100,000) compared to females (8.05 per 100,000). The highest overall age-standardised CRC mortality rate per 100,000 was among Chinese (11.85), followed by Malays with 9.56 and Indians with 7.08 (Hassan et al., 2016).

2.5 Symptoms of colorectal cancer (CRC)

Individuals may experience mild or absent symptoms during the early stages of CRC. Early symptoms of CRC are correlated with intestinal motility issues in conjunction with diarrhoea, mucus in the stool, rectal pain, and tenesmus (Majumdar et al., 1999). According to previous research studies, it has been identified that the most common early symptoms reported by patients diagnosed with CRC rectal bleeding, abdominal pain, change in bowel habits, constipation, diarrhoea and weight loss (Adelstein et al., 2011). Another study found that rectal bleeding and weight loss were the two symptoms significantly associated with a subsequent diagnosis of CRC through a systematic review. They found that these two symptoms were independently associated with cancer and not

with adenomas and that weight loss was the most specific symptom (Adelstein et al., 2011). Because of the identifiable characteristic and correlation between rectal bleeding or blood in stool and cancer incidence, the Adelstein et al. study suggests focusing on faecal occult blood tests (FOBT) as the future of first-line screening for CRC. A recent research study conducted among outpatients of Serdang hospital reported that 'bleeding from the back passage' was the most commonly recognised symptom for CRC (Pan et al., 2017).

Besides that, a systematic review found that forty research studies concluded 'rectal bleeding'; meanwhile, eighteen research studies proved weight loss is the two early symptoms significantly associated with a diagnosis of CRC (Adelstein et al., 2011). Furthermore, a prospective study was carried out between October 1999 and June 2003 among patients with primary symptoms of CRC. This study found that patients from the early-diagnosed group had rectal bleeding (89%), a change in bowel habits (58%), and abdominal pain (24%) as symptoms of CRC (Smith et al., 2006). A cross-sectional study among Danish CRC patients reported the patients mentioned blood in the stool as the essential CRC symptom, followed by changes in bowel habits, abdominal pain and other symptoms (Jensen et al., 2015). Other than this, blood in the stool, pain in the back passage, a lump in the abdomen, and tiredness are early symptoms of CRC. Many of the symptoms of CRC can also be caused by something that isn't cancer, such as infection, haemorrhoids, irritable bowel syndrome, or inflammatory bowel disease. People with these symptoms often do not have cancer (Simon, 2019).

Weight Loss

Unexplained weight loss is often a symptom of several types of cancer, including CRC. Losing 5kg or more in six months without any specific reason is referred to as unexplained weight loss (UPH, 2016). CRC can lead to unexplained weight loss in a variety of ways.

Cancer cells use a lot of the body's energy supply, for instance, the immune system, which works hard to fight the disease. Cancer cells can release substances into the body that change how food is converted to energy, which can cause weight loss. Additionally, if a cancer cell in the colon gets large enough, it could block the colon. This blockage can affect a person's bowel habits, leading to unexplained weight loss (UPH, 2016). Weight loss is one of the symptoms independently associated with CRC, as proved by two studies from the United Kingdom and Italy. Those studies' positive predictive weight loss values were 1.2% (Hamilton et al., 2005) and 35.7% (Panzuto et al., 2003).

Anemia

A common blood disorder characterised by low haemoglobin levels, has long been associated with CRC patients. Bleeding is seen as the leading cause of anaemia when affecting the colon. This is because the tumour releases certain chemicals that stimulate the formation of new blood vessels. As the tumour expands, the vessel bursts, causing loss of red blood cells (Väyrynen et al., 2018). Symptoms of anemia include shortness of breath, a feeling of tiredness and sluggish that does not resolve with rest (Simon, 2019). Prevalence estimates for CRC in patients with iron deficiency anaemia range from 5% to 10% in the United Kingdom; unexplained anaemia is considered to be a warning signal that warrants expert referral to exclude gastrointestinal cancers (Goddard et al., 2011; Pengelly et al., 2013; Raje et al., 2007). Anaemia was also proven to be one of the early symptoms of CRC through four studies of a total of 928 participants with positive predictive values of 40.6% (Panzuto et al., 2003), 8.59% (Yates et al., 2004), 6.92% (Lucas et al., 1996) and 2.30% (Farrus Palou et al., 2000). In addition, a study using primary care data from the THIN database has also shown that anaemia markers documented in primary care databases are associated with CRC (Hamilton et al., 2008).

Abdominal Pain and Bloating

A cancer growth can block the colon, causing sudden intense pains in the stomach area, bloating, and feeling or being sick. This is called a bowel obstruction. At some point in their lives, many people might have abdominal pain, which would seem minor. It is a common symptom of non-cancerous conditions such as haemorrhoids and irritable bowel syndrome. Furthermore, the right colon cancer pain is vague, dull, and annoying and may be confused with gallbladder disease or peptic ulcer. In addition, pain caused by left CRC is usually secondary to colon obstruction. It produces what the patient often refers to as 'gas' or 'cramps' in patients with rectal cancer (Leffall Jr, 1974). However, abdominal pain also can be a symptom of CRC if it is severe and long-lasting. CRC occurs in the large intestine, which can affect bowel habits. This change in bowel habits can lead to cramping, bloating, abdominal pain, and maybe a CRC indicator (UPH, 2016). Panzuto and his team concluded that both abdominal pain and bloating are strongly associated with early symptoms of CRC. The positive predictive values of abdominal pain were 13.5%, followed by bloating at 13.2% (Panzuto et al., 2003).

Rectal bleeding and Blood in Stool

Rectal bleeding is commonly known as hematochezia. It is the flow of red blood from the anus, frequently combined with urine and blood clots. It is called rectal bleeding since the rectum lies immediately above the anus. However, the red blood in the stool can come from the rectum. Most often, rectal bleeding or blood in the stool is from piles (haemorrhoids), especially if it is bright red, fresh blood. Piles are a prevalent anorectal disease characterised by the symptomatic expansion and distal displacement of the typical anal cushions. It is usually believed that constipation and prolonged straining induce haemorrhoids' because hard stool and increased intraabdominal pressure could hinder venous return, resulting in an enlarged haemorrhoidal plexus. Hard faeces increase the

shearing strain on the anal cushions, resulting in mild bleeding (Lohsiriwat, 2012). There are few other common causes of rectal bleeding from the colon other than piles, such as anal fissure, diverticulosis, colon cancer and polyps, colonic polyps removal, angiodysplasia, colitis, proctitis, and Meckel diverticula. Blood from higher up in the bowel doesn't look bright red; it goes dark red or black, making the bowel motions look like tar. This type of bleeding can be a symptom of cancer higher up the bowel. Rectal bleeding is blood flow from the lower colon or rectum. Usually, it's known as a common symptom of colorectal cancer. Bright red blood on the toilet paper may be a symptom of rectal bleeding or red or pink water in the toilet bowl after defecation. People usually correlate rectal bleeding to haemorrhoids, which can prevent an early CRC diagnosis (UPH, 2016). This was proven to be associated with CRC by Hamilton and his team through two different research one with the positive predictive value of rectal bleeding at 2.4% (Hamilton et al., 2005) and another at 4.5% (Hamilton et al., 2009). Blood in the stool is also known as one of the symptoms of CRC. There will be bright red spots on the stool, which may not be visible to the naked eye. The severity of the symptoms depends on the disease's progression and location. The stool may also appear very dark or black, indicating the presence of dried blood (UPH, 2016). Two separate studies, from Newcastle (Metcalf et al., 1996) (Fijten et al., 1995) and the Netherlands, found that blood in stool was statistically and significantly associated with CRC ($P < 0.001$).

Change in Bowel Habits, Diarrhoea, and Constipation

A colon polyp is a small clump of cells on the colon lining that, over time, can develop into a cancerous cell. The cancerous cell's slow growth often affects bowel habits, such as thinning the stool or changing the frequency of defecation, which could be a symptom of colorectal cancer. CRC can also inhibit the ability of the large intestine to perform its regular functions, such as emptying the body's waste, including absorbing water and

nutrients from food. This can be seen through the drastic changes in stool consistency, an early symptom of CRC. The changes in stool are loose stool, watery stools, diarrhoea, or constipation. Those are common early symptoms that were demonstrated in 2003 by a research team from Italy with the positive predictive value of constipation (15.7%) followed by the change in bowel habits (14.0%) and diarrhoea (11.8%) (Panzuto et al., 2003). In addition, a change in bowel habits is one of the most common cancer symptoms among elderly individuals (Lawrenson et al., 2006).

Rectal Tenesmus

Rectal tenesmus is a painful sensation of incomplete bowel evacuation, resulting in a feeling of defecation several times a day. During defecation, there is a feeling of inability or difficulty to empty the large intestine despite the intestine's contents having already been evacuated. This suggests that the feeling of a residue has not always been correlated with the actual presence of stool residue in the rectum, which threatens continence once defecation is complete. It is frequently painful and accompanied by involuntary straining, cramping, or other gastrointestinal symptoms. The association between CRC and rectal tenesmus was statistically significant and proven through two research studies, one conducted in Sudan (Taha et al., 2015) and another in Spain (Pita-Fernández et al., 2016).

Pain in Back Passage

Pain in the Back Passage is a pain or discomfort that can occur before, during, or after defecation in the lower portion of the gastrointestinal tract (anal). It can range from mild burning pain that might worsen over time, leading to restricting everyday activity. A common cause is a slight tear in the skin of the anus that can be caused by passing through a large or hard stool.

2.5.1 Awareness of colorectal cancer (CRC) symptoms

The majority of the Malaysian population lacks awareness of the early symptoms of CRC, which leads to a delay in the early detection of the disease. Early detection of CRC is crucial for successful treatment outcomes and improved survival rates. Besides, this also can significantly impact a patient's prognosis and quality of life. Awareness of the symptoms among the public plays a significant role in facilitating early diagnosis. Awareness of CRC symptoms is critical as it helps detect CRC early and with a positive prognosis. Obtaining awareness can be practicable and achievable. However, a lack of adequate awareness of CRC symptoms, a lack of education about the seriousness of CRC symptoms, and ignorance are the key causes of late detection of CRC (Quaife et al., 2014; Yardley et al., 2000b).

2.6 Risk factors of colorectal cancer

A risk factor increases the chance of a person developing CRC. Thus, risk factors always influence cancer growth, but most will not cause CRC directly. Some people with multiple risk factors never develop cancer, while others do not have known risk factors. The risk factor of CRC is very complex, involving interactions between environmental factors and hereditary susceptibility (Wallin et al., 2010). An individual with an average CRC risk factor has an overall 5% chance of developing CRC. The risk factor for CRC can occur in two primary forms: sporadic CRC and hereditary CRC. Approximately two-thirds (70% -75%) of new CRC cases are sporadic, meaning that genetic changes develop by chance after a person is born, so there is no risk of transmitting these genetic changes to children (Kang et al., 2011). The necessary genetic changes occur in these sporadic cases, caused by etiological factors such as age and gender, diet, lifestyle factors, and environmental exposure. Thus, generally, less than 5% of CRC cases are hereditary CRCs

that occur when gene mutations or changes are passed from one generation to the next within a family (Giglia & Chu, 2016).

2.6.1 Demographics (Age, Gender, and Ethnicity)

Although CRC affects all age groups, its risk of development increases with age. In Malaysia, more than 90% of CRC cases are diagnosed among people over 40 years old, which has been observed for all ethnic groups (Lim et al., 2008; Syful et al., 2015). The risk of developing CRC among males tends to be higher than in females, increasing after 40 years and sharply after 50 years (Hassan et al., 2016). A similar pattern was observed in Malaysia and Singapore, where the diagnosis of CRC is higher among people aged 50 years and above (SCS, 2016). In addition, the incidence of CRC among the Indian (16.1) and Malay (26.1) populations is significantly lower compared to the Chinese (34.1) population, which is almost identical to the Malaysian population (Veettil et al., 2017). The highest proportion of CRC cases was diagnosed in patients aged 60–69, where a similar trend was observed in Singapore (Lim et al., 2012; Peng, 2015). CRC in the United States is now one of the ten most frequently diagnosed cancers among males and females aged 20 to 49 (Fairley et al., 2006). Robb and his colleagues (2004) reported that demographic characteristics as the risk factor for developing CRC were taken into account (Robb et al., 2004). They also found that age differences were significant to perceived risk but relatively small.

2.6.2 Genetic

Approximately 20–30% of CRC diagnoses are associated with a family history (Tárraga López et al., 2014). It has been estimated that those with a family history of colorectal cancer in a first-degree relative (one of the individual's parents, a brother, or a sister had the disease) have a 2.3- to 4.3-fold increased risk of developing CRC compared

to those without such a history (Butterworth et al., 2006; Zlot et al., 2012). The risk is greater for those with relatives who have early-onset CRC (diagnosed when young, i.e., before age 50) than those with relatives diagnosed later in life (Church, 2005) and for those with more than one family member with the disease (Slattery et al., 2003). In addition, those with a personal medical history of other types of cancer, a history of colon polyps, or inflammatory bowel diseases (Zeller et al., 2008) have also been shown to have a greater risk for CRC.

Genetic vulnerability to colon cancer has been attributed to either polyposis or non-polyposis syndromes. The primary polyposis syndrome is familial adenomatous polyposis syndrome (FAP), associated with a gene mutation in the adenomatous polyposis coli (APC). Non-polyposis is known as hereditary non-polyposis CRC (HNPCC) syndrome and is associated with gene mutation involved in the deoxyribonucleic acid (DNA) mismatch repair pathway (Labianca et al., 2010). FAP and HNPCC are the most common syndromes of the family colon cancer, but these two conditions combined contribute to just around 5% of CRC cases, the majority of which are HNPCC (Burt et al., 1995; Lynch et al., 1993; Ponz de Leon et al., 1993; Yurgelun et al., 2017). In a survey of 1058 people who visited a tertiary American Cancer Centre with CRC, 105 patients had one or more pathogenic mutations. Seventy-four percent transmitted HNPCC mutations, including mutations in high-penetrance genes (APC, biallelic MUTYH, BRCA1, BRCA2, PALB2, CDKN2A, and TP53) (Yurgelun et al., 2017).

2.6.3 Lifestyle

Smoking and Alcohol consumption

Alcohol consumption and smoking cigarettes are typical cancer risk factors, including CRC. Alcohol consumption can increase cancer risk by increasing the levels of hormones,

through metabolism, or by making cells more vulnerable to other carcinogens. It is suggested that ethanol metabolites are genotoxic, possibly compromising the genetic material of cells, which contributes to the carcinogenic effect on the human body (Simon, 2019). Recent studies show a positive correlation between CRC-serrated polyps, adenomas, and carcinomas over the recommended dosages, where one drink for women and two for men per day (Fagunwa et al., 2017). Daily alcohol consumption of ≥30g was positively associated with an increased risk of CRC (Bongaerts et al., 2007). The individual who consumed more than 12 drinks per week compared with non-drinkers (OR: 1.21; 95% CI: 1.03-1.44) had an increased risk of CRC (Poynter et al., 2009). A meta-analysis of 27 retrospective and 34 case-control studies revealed a substantial increase in CRC risk among moderate (two to three drinks per day, overview RR 1.21, 95% CI 1.13-1.28) and heavy drinkers (including four drinks per day, RR 1.52, 95% CI 1.27-1.81) but minimal drinkers (including one drink per day, overview RR 1.00, 95% CI 0.95-1.05). There is a dose-response relationship found in a study from Japan (Mizoue et al., 2008), but not among Singaporeans who consumed alcohol seven or more times per week (Tsong et al., 2007). It has been reported that both frequent and high amounts of alcohol consumption had positive associations with the risk of distal colon cancer in Korean men and rectal cancer in Korean women (P-trend < 0.001, respectively) (Shin et al., 2011). Another study between 1993 and 2003 with more than 166,000 patients with enteric carcinomas identified a positive relationship between those who consume alcohol and younger CRC patients (Zisman et al., 2006). This study was supported by observations that link alcohol consumption to distal tumours and distal tumours being diagnosed at higher rates in younger individuals (Aleksandrova et al., 2014). Besides that, a study found a significantly stronger correlation between drinking alcohol and the risk of CRC in Asian studies than in other geographical regions (Fedirko et al., 2011).

Cigarette smoke may also be responsible for the formation and growth of adenomatous polyps, which can cause CRC, especially with long-term exposure to smoke (Haggar & Boushey, 2009). Evidence shows the interaction between cigarette smoke and alcohol consumption and CRC. The interaction is with mutations in DNA that may be induced by cigarette smoke exposure with alcohol present (Haggar & Boushey, 2009). Few studies have used nicotine and carcinogens in tobacco to explore the relationship between smoking and cancer development (Hannan et al., 2009; He et al., 2022; Huang et al., 2022). Nicotine was found to stimulate colon cancer cell (SW1116) proliferation via Epidermal Growth Factor Receptor (EGFR). It also promotes colon cancer cell (HT29) proliferation through the alpha7-nAChR (nicotine acetylcholine receptor and induction of adrenaline production and beta-adrenergic activation in a dose-dependent manner.

Additionally, nicotine-induced COX-2 and fibronectin expression through nAChR enhance the migration of colon cancer cells (SW480 and DLD-1). In vitro studies on cigarette smoke have shown to promote cancer cell growth by increasing the expression of 5-lipoxygenase (5-LOX), vascular endothelium growth factor (VEGF), matrix metalloproteinase (MMPs) 2 and 9 in SW116 cells and stimulated HUVEC proliferation (Ye et al., 2005). Among tobacco carcinogens, NNK, which is formed by the nitrosation of nicotine, was found to stimulate colon cancer cell proliferation and metastasis through alpha7-nAChR receptor in vitro studies. Hence, continuing smoking in CRC patients will promote tumour proliferation and metastases, the leading cause of cancer death (Wei et al., 2011; Ye et al., 2004). On the other hand, the association between cigarette smoke exposure and CRC has been inconsistently reported due to differences in assessing long exposure times and latency periods of cancer onset (Peppone et al., 2009). Microsatellite Instability (MSI) is known to occur in about 15% of colon tumours and is characterized by mutations in the DNA sequence. Slattery et al. found that subjects who started smoking at a young age, with more than 20 cigarettes per day and a history of over 35 years of

smoking, had a higher risk of developing MSI, with about 21% of MSI in colon cancer being due to cigarette smoking (Slattery. et al., 2000).

Diet

Diet is often known as a possible risk factor that is frequently associated with CRC. Recently, the World Cancer Research Fund (WCRF) and the American Institute for Cancer Research (2017) provided an updated and comprehensive review of the evidence on the link between diet and lifestyle-related risk factors and CRC, which was updated in early 2018 (AICR, 2017). This was expanded from the 2007 second expert report on the scientific literature on diet, physical activity, and prevention of cancer (AICR, 2007). The main factors identified by WCRF that increase the risk of CRC are high body and abdomen fat, high intakes of red and processed meat, and foods containing fibre that appear to protect against CRC. Garlic, milk, and calcium decrease the risk of CRC. Studies have suggested that a 'Western diet', characterised by high meat, fat, and refined grains intake, is associated with a significantly increased risk of CRC (Rock et al., 2020).

In contrast, a 'prudent diet,' characterised by high fruit, vegetable, and fish intake, is non-significantly associated with a reduced risk of developing colon cancer (Fung et al., 2003; Wu et al., 2004). The Continuous Update Project (CUP) for colorectal cancer indicated that foods with high folate levels, higher seafood consumption, and higher selenium consumption are associated with an increased risk of developing colorectal cancer. Therefore, this statement lacks coherence and is insufficient to support a conclusion. In contrast, the evidence was rated as convincing that increased consumption of foods containing dietary fibre was protective against CRC, while higher consumption of red and processed meat was deemed to increase the risk of CRC (AICR, 2017).

The CUP identified a low intake of dairy foods and calcium as a high-risk for CRC development (AICR, 2017). Calcium is often known as a colon cancerous protective

agent and is attributed to the intake of dairy products. A pooled analysis of ten prospective studies by Cho et al. (2004) found that people with high milk and calcium intake were at lower CRC risk (Cho et al., 2004). Other dairy products, such as cheese, butter, cream, and ice cream, produced a suggestive inverse relationship, implying that calcium may have a small protective role against CRC. The Academy of Nutrition and Dietetics's position paper on fibre also concludes that due to convincing evidence analysed by the WCRF and results of the EPIC study, all dietary fibres contribute to a decreased risk of CRC in a dose-dependent fashion (Dahl & Stewart, 2015). WCRF has identified the slight and nonlinear inverse relationship between fruit and non-starchy vegetable intake associated with CRC through CUP (AICR, 2017). This relationship was observed mainly on intakes of approximately 100 grams per day. When studied alone, non-starchy vegetable intake had an inverse relationship with CRC development (Johnson et al., 2013). Furthermore, comparing the highest versus lowest vegetable intakes showed a 14% reduction in CRC risk (AICR, 2017; Johnson et al., 2013). Eating one or more fruits per day showed a decrease in CRC risk reduction (Johnson et al., 2013).

Physical Activity

Physical activity has been shown consistently to reduce colon cancer incidence and mortality. Therefore, physical activity is one of the crucial aspects of managing cancer and preventing cancer in both a primary and secondary prevention sense. CRC is the most common cancer related to physical activity. A scientific report by CUP reported a decreased risk of CRC with increased total physical activity (AICR, 2017). A previous study showed that increased exercise affects several functions of the human body that might influence cancer risks, such as immune, antioxidant defense, endogenous hormones, and energy balance (Al-Otaibi, 2013; Batty & Thune, 2000). According to Haydon and his team, physical activity may specifically influence CRC development by

reducing abdominal fat mass (adiposity), which is metabolically active and implicated in carcinogenesis (Haydon et al., 2006).

In addition, a systematic review of epidemiologic studies revealed that for household physical activity approximately every 10 MET-hours/week or 1 hour/week increase is associated with a 1% reduction in cancer risk (Shi et al., 2015). It was associated with a more significant protective effect than activities of less intensity. Physically active men and women exhibited a 30%–40% reduction in the relative risk of colon cancer, and physically active women a 20%–30% reduction in the relative risk of breast cancer compared with their inactive counterparts (Warburton et al., 2006).

Many studies agree that there is an inverse relationship between physical activity and cancer mortality and incidence (Brenner et al., 2018; Kerr et al., 2017; Shaw et al., 2018). Many government and independent agencies point out the potential protective effect of physical activity and recommend moderate exercise of at least 150 minutes per week to maintain health ("Physical Activity Guidelines"). Physical activity has shown a benefit for those at higher risk for CRC than the average individual.

Additionally, Simon et al. (2013) investigated the relationship between occupational energy expenditure, sitting time, non-occupational physical activity, and participation in sports with CRC risk. The study reported that high occupational energy expenditure and fewer sitting hours could reduce hazard ratios for colon cancer in men. Non-occupational physical activity was found to have inconsistent associations with the endpoint of CRC among men. Still, an inverse association was found between non-occupational activities and CRC endpoint among women (Simons et al., 2013).

2.6.4 Chronic Illness

Diabetes

Type 2 diabetes mellitus (T2DM) poses a recognised risk factor for CRC, drawing considerable attention due to its substantial impact on health (Yu et al., 2022). Research consistently highlights the correlation between diabetes and an elevated susceptibility to developing CRC.

The underlying mechanisms driving this association include insulin resistance and hyperinsulinaemia, which are prevalent in diabetes. Heightened insulin levels and resistance not only contribute to metabolic disturbances but also create an environment conducive to cancer cell growth, particularly in the colon and rectum (Tabák et al., 2009). Insulin plays a crucial role as a growth factor for colonic epithelial cells and acts as a stimulant for tumour cell growth in laboratory settings (Giovannucci, 2001). Additionally, insulin can potentially contribute to the development of colorectal cancer indirectly by elevating the levels of bioavailable insulin-like growth factor 1. This increase in IGF-1 may lead to enhanced cell proliferation and the inhibition of apoptosis (Sandhu et al., 2002). Another plausible biological connection between T2DM and cancer involves hyperglycemia. Elevated blood sugar levels in diabetes could hinder the impact of ascorbic acid on intracellular metabolism, diminish the effectiveness of the immune system, and regulate the levels of reactive oxygen species (Yu et al., 2022). These physiological changes may create an environment conducive to the development and progression of cancer, including CRC, in individuals with diabetes.

Numerous epidemiological studies have consistently indicated an increased likelihood of CRC development in individuals with T2DM in comparison to those without T2DM (Cavicchia et al., 2013; de Kort et al., 2016; Flood et al., 2010; He et al., 2010; Seow et al., 2006; Sun & Yu, 2012). A meta-analysis conducted by Yuhar H et al. supports this

by indicating a 20% - 40% increased risk of colorectal cancer in individuals with T2DM compared to non-T2DM individuals (Yuhara et al., 2011).

As part of epidemiological research in Malaysia, a study revealing a robust association between T2DM and an increased incidence of CRC. This investigation was carried out in Kelantan, Malaysia and unveils a worrisome pattern by indicating that individuals diagnosed with T2DM encounter a significantly elevated risk of developing CRC (Othman & Zin, 2008). The burden is further compounded by Malaysia's escalating rates of both T2DM and CRC. The prevalence of T2DM in Malaysia has been on the rise, attributed to various lifestyle factors and an ageing population (Akhtar et al., 2022). Simultaneously, CRC remains one of the leading cancers among Malaysians, contributing significantly to the country's cancer burden.

Obesity

Obesity contributes directly and independently to the development of CRC. The mechanisms underpinning this association are multifaceted. A review summaries the various potential underlying mechanisms that link obesity to CRC. These mechanisms include gut microbiota, bile acids, inflammation, adipokines and hormones, and nutrition (Ye et al., 2020). The strong association between obesity and an increased risk of developing CRC has been consistently highlighted in numerous epidemiological studies worldwide (Alsheridah & Akhtar, 2018; Bardou et al., 2022; Seo et al., 2023).

Obesity is described by an abnormal accumulation or distribution of body fat, especially excessive visceral adipose tissue, which negatively impacts health. The presence of central obesity, characterised by excess fat around the waist and abdomen, is strongly associated with an increased risk of CRC (Ye et al., 2020). Body mass index (BMI) and waist circumference (WC) are commonly used to measure this condition (Seo et al., 2023). Obesity contributes to a chronic inflammatory state within the body, alters

hormone levels (such as insulin and insulin-like growth factors), and influences metabolic pathways (Pati et al., 2023). Collectively, these factors create an environment conducive to the initiation and progression of CRC cells.

According to two recent systematic reviews, the risk of CRC is approximately 30% higher in obese people than in normal-weight people (Lei et al., 2021; Zhang et al., 2021). Another meta-analysis discovered that each 5-unit increase in BMI increased the risk of colon cancer by 30% in men and 12% in women (Kyrgiou et al., 2017). Multiple studies that conducted in Malaysia, demonstrate a clear and significant link between obesity and the elevated incidence of CRC (Ramadas et al., 2009; Shafiee et al., 2023; Ulaganathan et al., 2018). These studies, spanning diverse populations and longitudinal analyses, consistently reveal that individuals classified as obese face a notably higher risk of developing colorectal cancer compared to those within healthier weight ranges.

Colorectal-related Diseases

Colorectal-related diseases represent a significant cluster of risk factors for CRC, comprising conditions that predispose individuals to an elevated likelihood of developing this malignancy. In particular, inflammatory bowel diseases (IBD) such as ulcerative colitis and Crohn's disease have been consistently identified as key contributors to colorectal cancer risk (Young, 2018). The likelihood of developing the condition surges by 20-fold in individuals with ulcerative colitis and triples in those with Crohn's disease (Lewandowska et al., 2022; Stidham & Higgins, 2018).

Studies underline the association between IBD and an increased incidence of CRC (Eaden et al., 2001; Jess et al., 2012). Chronic inflammation and persistent damage to the colonic epithelium in individuals with IBD create an environment conducive to the development of colorectal neoplasms (Temby et al., 2023).

Furthermore, colorectal adenomas, which are benign tumours often precursors to CRC, serve as another significant colorectal-related disease that heightens cancer risk. The presence of adenomas is a well-established risk factor, illustrating the association between a history of adenomas and an elevated likelihood of subsequent CRC development (Tuohy et al., 2014).

2.7 Attitudes and beliefs toward colorectal cancer

A literature study suggests that being worried about what the doctor might find (Robb et al., 2009a) and being busy and not bothered (Yusoff et al., 2012b) are potential negative attitudes and beliefs about seeking early medical advice. It's worth noting that almost 40% of people believe that if they go to the doctor, they might be "wasting their time," which could cause them to delay seeking medical attention. This suggests that some people might not feel confident that their symptoms require medical attention or they might perceive their doctor as too busy to be bothered with their concerns. To address this issue, primary care initiatives should empower people to believe that their symptoms are important and deserving of medical attention. Educational interventions can highlight the benefits of early detection and the effectiveness of various cancer treatments to help prioritise what the doctor discovers. The most commonly cited barrier to seeking medical attention was "difficulty making an appointment." This perception should change as primary care services continue to improve. In this study, approximately 40% of participants, along with a comparable proportion of the general population, agreed that scheduling an appointment with their doctor would be challenging (Robb et al., 2009a).

The common beliefs mentioned by South Asians (SA) included a strong sense of family cohesiveness, demonstrating honour, respect, and dependence. Respecting and honouring the family was maintained by not discussing sensitive issues related to women's health, such as breast cancer, within the family or with others within the

community (Banning & Hafeez, 2010; Bottorff et al., 2001). As a result of this 'ethnocultural discordance,' few people also felt that the healthcare system is made respectful or accommodative of their cultural or traditional perspectives on health (Lobb et al., 2013). The physician's role in promoting cancer screening was believed necessary to access screening tests (Lobb et al., 2013). The level of trust with doctors or other healthcare workers was also an enabling predictor for faecal occult blood test (FOBT) uptake among SAs (Menon et al., 2014). Some of them believed that cancer was "incurable" (Randhawa & Owens, 2004) and not a disease that could be prevented or controlled (Meana et al., 2001). Beliefs about cancer included that it was a punishment for past sins, that it was a result of bad lifestyle choices like promiscuity and lack of physical activity, and that it was a form of retribution (Meana et al., 2001; Pfeffer, 2004). Worse, the stigma associated with a cancer diagnosis has the potential to damage a family's reputation (Karbani et al., 2011). In particular, some male South Asian immigrants avoided screening because of the stigma or taboo associated with seeing a doctor to discuss cancer screening (Gesink et al., 2014). Besides that, some believed that breast cancer was seen as a 'white woman's disease' (Bottorff et al., 1998) because they did not breastfeed their children (Pfeffer, 2004). Also, some perceive that screening was for younger women (Thomas et al., 2005), and cancer was not a risk for women of their respective culture (Poonawalla et al., 2014; Wu et al., 2006).

2.8 Colorectal Cancer (CRC) Screening

Multiple organizations have developed CRC screening guidelines for average risk individuals. The first update by the American Cancer Society (Wolf et al., 2018) was followed by the US Preventive Services Task Force (USPSTF, 2021). The American College of Gastroenterologists (ACG) released updated (2021) CRC screening guidelines for average risk individuals (Shaukat et al., 2021). The ACG's latest guideline makes a

conditional recommendation to screen people of average risk between ages 45 and 49 years (Shaukat et al., 2021). This recommendation is consistent with the American Cancer Society's 2018 qualified recommendation (Wolf et al., 2018) and the USPSTF's (2022) Grade B recommendation. Grade B indicates a recommended service with a high certainty of a moderate net benefit or moderate certainty that the net benefit is moderate to substantial; providers should either provide or offer this service.

The ACG considers there to be two types of screening options: 1) 1-step colonoscopy which is both diagnostic and therapeutic and 2) 2-step options, all of which require a follow-up colonoscopy when the first step is positive. The ACG prefers the colonoscopy as this test allows the detection of early stage CRC and also allows the removal of polyps. Their second-most preferred test is the fecal immunochemical test (FIT), annually. This test replaced the guaiac fecal occult blood testing (gFOBT) because of its higher sensitivity, requirement for a single sample, better patient adherence, and no medication or dietary restrictions. The FIT, when completed annually, has a comparable life-years gained when compared with a colonoscopy recommended interval of every 10 years (Shaukat et al., 2021).

2.8.1 Faecal Occult Blood Testing (FOBT) or Faecal Immunochemical Test (FIT)

There are a few synonym names for FOBT, such as guaiac-based faecal occult blood testing, faecal immunochemical test, immunoassay faecal occult blood test, immunochemical faecal occult blood test, and immunologic faecal occult blood test. FOBT measures the heme (non-protein) part of haemoglobin from blood in the stool. Since the heme part of haemoglobin is common to blood from all sources, this method identifies the presence of blood from any source (Kościelniak-Merak et al., 2018). This means that FOBTs will measure your blood and blood from any dietary source, such as red meat, causing false-positive test results. Compared to the FIT, these methods have

other limitations. Certain foods and medications can interfere with this method, so instructions may be given to avoid them for a few days prior to testing. Since the heme part of haemoglobin is resistant to degradation in the intestine, these tests also detect blood from other areas of the digestive tract, such as bleeding stomach ulcers and bleeding gums ((MP), 2019). Therefore, they are less specific than the FIT for detecting bleeding from the colon.

For the FOBT test kit, a test card that has 1, 2, or 3 sections can be obtained through a healthcare practitioner or laboratory. The stool should be collected into clean containers and should not be contaminated with urine or water. A sample is collected from the stool's surface using an applicator stick, placed onto the specially treated pad on the test card, and allowed to dry. The 3-section card requires three stools, each collected on a different day. Collecting and testing multiple stool samples increases the chance of detecting cancer if it is present.

A FIT test involves collecting faeces on a card or tube, mixing it with a solution, and sending it in for analysis. Usually, a small sample is necessary. This can be done at any privacy space such as own residence. Unlike the FOBT, there are no drug or dietary restrictions before the test and collecting the samples may be easier. Moreover, most health organisations, including the U.S. Multi-Society Task Force (MSTF) and the American Gastroenterological Association, recommend this test for screening for colon cancer.

2.8.2 DNA stool test

DNA stool tests for CRC have emerged as promising noninvasive screening tools revolutionising early detection. These tests analyse stool samples to detect specific DNA markers associated with CRC, offering a convenient, cost-effective and effective method

for identifying potential malignancies (Hoffman et al., 2021; Ladabaum & Mannalithara, 2016; Schroy & Heeren, 2005).

Tests like Cologuard®, which assess DNA alterations, including mutations and abnormal methylation patterns in stool samples, have shown remarkable accuracy in detecting CRC and precancerous lesions (Dhaliwal et al., 2015). Studies such as Imperiale et al. (2014) and Robertson et al. (2015) have highlighted the efficacy of DNA stool tests in detecting colorectal neoplasms, emphasising their potential as screening tools (Imperiale et al., 2014; Robertson & Imperiale, 2015).

The advantages of DNA stool tests lie in their non-invasiveness and ease of use, which encourages higher compliance rates compared to conventional methods like colonoscopy. These tests are particularly beneficial for individuals averse to invasive procedures or those facing barriers to undergoing colonoscopies (Rex et al., 2017).

DNA stool tests represent a ground-breaking advancement in CRC screening, offering a noninvasive and convenient option for early detection. However, despite their effectiveness, this test does have limitations (Osborn & Ahlquist, 2005). While they exhibit high sensitivity for detecting cancer, their specificity can be relatively lower, leading to false-positive results. Consequently, positive findings often necessitate subsequent confirmatory colonoscopies, increasing the overall cost and potential for unnecessary invasive procedures (Carethers, 2020).

2.8.3 Flexible sigmoidoscopy

Flexible sigmoidoscopy (FS) is an endoscopic inspection of the rectum and sigmoid colon (the most distal section of the large intestine) using a thin, flexible tube fitted with a charged coupled device (CCD) or a fibre-optic camera (Figure 2.2) (Atkin et al., 2001). Images from the scope are seen on a video screen. A trained nurse or physician performs the test at a clinic or hospital. It takes between five and ten minutes to complete,

depending on the need for polypectomy (the removal of polyps) and biopsy (the sampling of tissue) (Eddy, 1990). Individuals undertaking the procedure are generally given an enema to prepare the distal intestine (the rectum and sigmoid colon) for review. The person may provide an enema at home or the hospital on the examination day. When the intestine is not sufficiently prepared for testing, it may be appropriate for the patient to undergo a second enema to ensure that a practical test can be carried out. The person does not need to be sedated during the procedure. However, it can be painful, especially when the intestine needs to be inflated (this is done to help the endoscope through the intestine and is accomplished by injecting small quantities of air or carbon dioxide into the intestine). Most people (87%), however, report no pain or only mild pain (Robb et al., 2012), and almost all (98%) find the test to be highly acceptable (Taylor et al., 2000). If any polyps are found during the test, the doctor may remove them with a small instrument passed through the scope. The polyps will be looked at in the lab. If a precancerous polyp (adenoma) or CRC is found, the patients are advised to have a colonoscopy to look for polyps or cancer in the rest of the colon (ASCO, 2019).

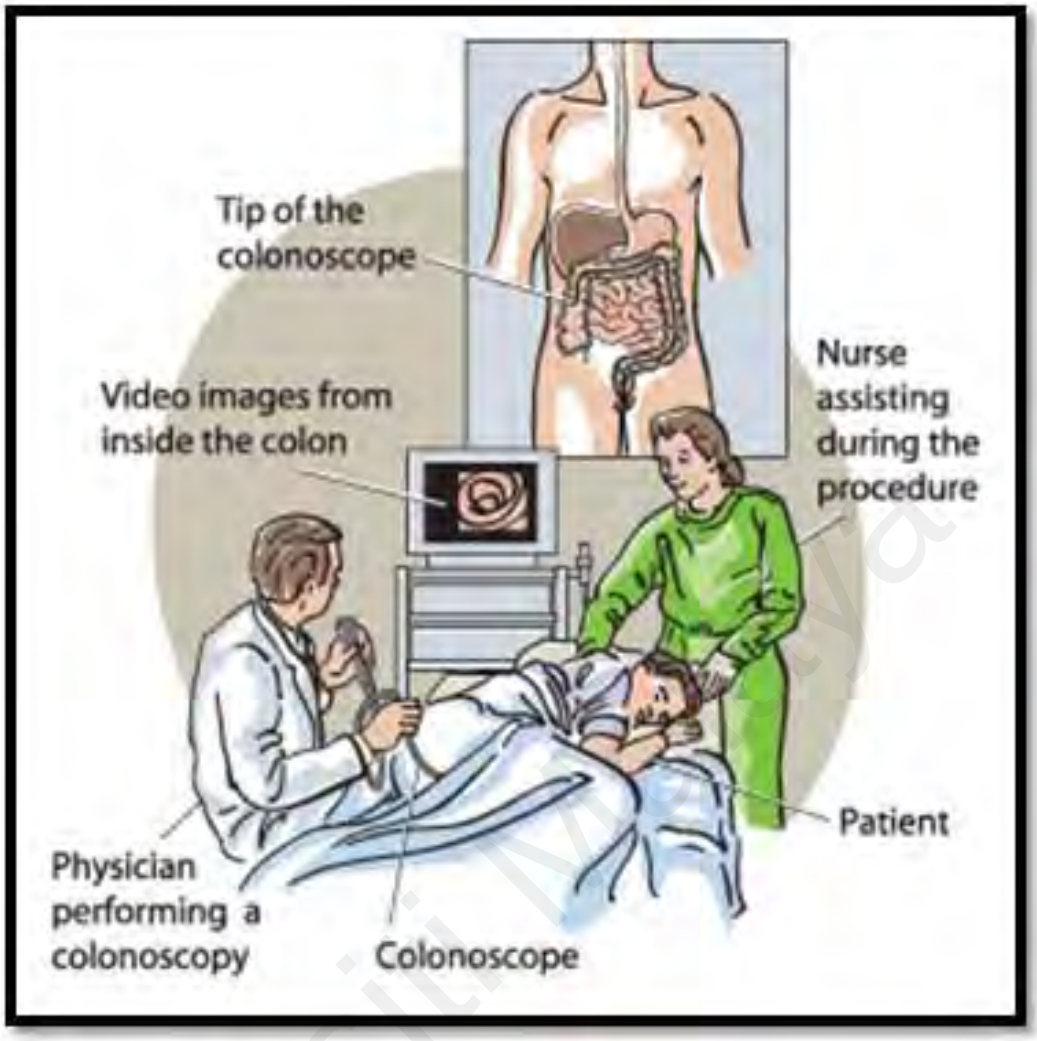

Figure 2.2: Patient positioning and room set-up for sigmoidoscopy and colonoscopy
Adapted from (Anonymous, 2014)

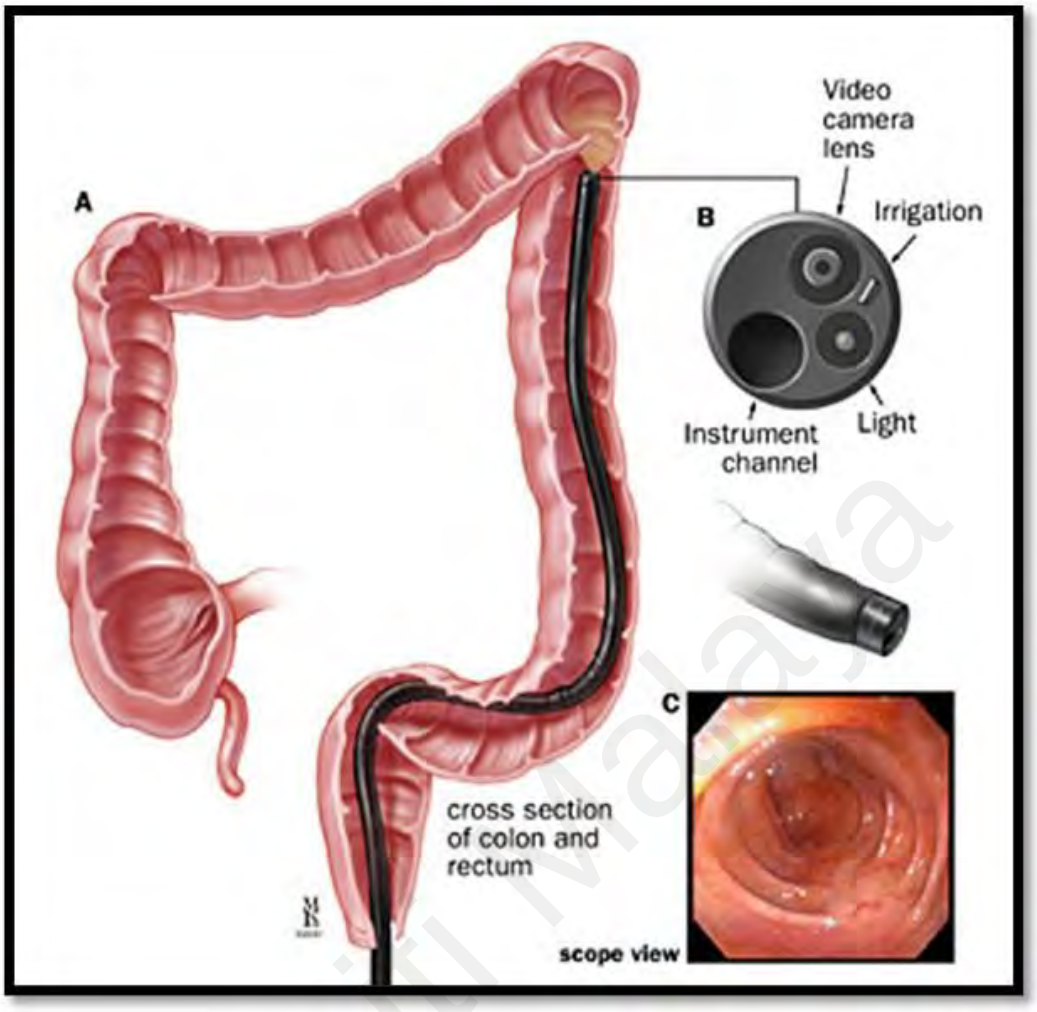

Figure 2.3: A: Sigmoidoscope examining the colon; B: Detail view of the scope tip; C: Scope image of the lumen of the colon
Adapted from (Anonymous, 2013)

While in absolute terms, only a relatively small portion of the large intestine can be examined using FS (approximately one-third), the sites that can be observed are those most frequently affected by cancer. Around two-thirds (58% to 75%) of all CRCs and 80% of all colorectal adenomas (72% to 86%) develop in the rectum and sigmoid colon (Corley et al., 2013; CRUK, 2015; Whitlock et al., 2008) meaning that the majority of cases can be detected without examining the whole bowel. Furthermore, the detection of one or more distal adenomas during FS could be used as an indicator for lesions occurring in the proximal colon, with about one-third (31%) of all persons with distal adenoma detected at FS also having one or more proximal adenomas detected at colonoscopy (Imperiale et al., 2000; Lieberman et al., 2000). Follow-up colonoscopy can be used in

conjunction with FS to enable the subsequent detection of most adenomas and CRCs (Whitlock et al., 2008). As with other screening modalities, the extent to which follow-up colonoscopy increases the number of adenomas and CRCs detected is highly susceptible to drop out, with only those who attend colonoscopy benefitting from the advantages of having the test (Plumb et al., 2017).

2.8.4 Colonoscopy

Colonoscopy is an endoscopic analysis of the large intestine using a flexible tube fitted with a CCD or fibre-optic camera (Atkin et al., 2001). It differs from FS because it allows examination of the whole intestine, not just the rectum and sigmoid colon (Figure 2.4). A qualified physician usually performs the test in a hospital and takes about thirty to forty-five minutes to complete, depending on the biopsy and polypectomy required (Overholt, 1975). Patients needed to prepare for the home test using a 'full-laxative' preparedness before colonoscopy. This requires drinking an herbal purgative drink and adhering to specific dietary guidelines. One common method of dietary advice is to consume only non-solid food and drink plenty of fluids for two days before the test, then forego solid food for the final day before the test. If the preparation of the intestine isn't enough, the patient may be invited to return for another appointment. The test is performed with sedation. Patients are treated for at least one hour after the test (while the sedative is wearing off) before being discharged by a nurse if there are no complications. Besides, flexible sigmoidoscopy pain ratings were higher than for colonoscopy. This could be because colonoscopy is commonly done under conscious sedation. During the colonoscopy, CRC precursor lesions (polyps) may be removed directly, so significant benefits are that no further investigation is required and that histology diagnosis can be obtained. There is also a preventive effect for CRC development by removing precursor lesions. A small piece of removed polyp or tumour will be biopsied and checked in the

lab to confirm whether it's cancer, a benign (non-cancerous) growth, or something else (ACS, 2019).

If no abnormalities are found during colonoscopy, evidence shows that the examination can be repeated after ten years (B. Levin et al., 2008; Singh et al., 2006). A German study also indicates a low risk of developing CRC after a negative colonoscopy, so a one-time colonoscopy may suffice (Brenner et al., 2018). Sensitivity is estimated to be 95% for CRC and 88-98% for advanced neoplasia (Lieberman, 2010), depending on the endoscopist's skills. Possible colonoscopy risks include bleeding, perforation, and, though unusual, death. The perforation rate for total colonoscopies is 1 in 1400 and 1 in 1000 for therapeutic colonoscopies (Panteris et al., 2009). In most studies, mortality is 0%, with the highest reported being 0.02% (Panteris et al., 2009). Colonoscopy is projected not to be cost-effective, and the evidence is inconclusive on whether colonoscopy screening is cost-effective (Lansdorp-Vogelaar et al., 2009; Loeve et al., 2000; Sieg & Brenner, 2007).

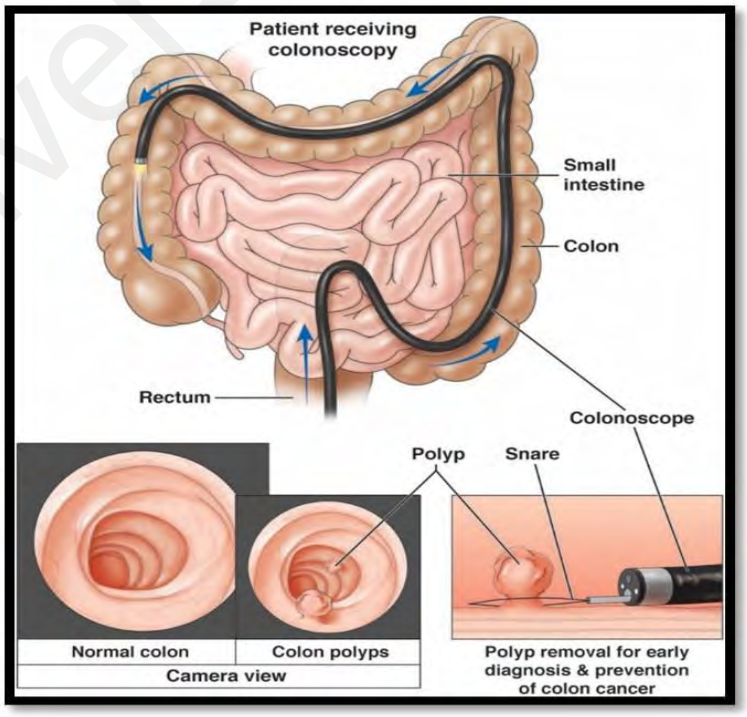

Figure 2.4: Position of the colonoscope and endoscopic view in the colon Adapted from (Anonymous, 2021)

2.8.5 Computed tomography colonography

Computed Tomography (CT) Colonography, also known as virtual colonoscopy, has emerged as an alternative method for CRC screening, utilised an advanced visualisation technology that permits a noninvasive approach to examine the colon and rectum. This imaging technique employs CT scans to generate detailed images of the colon, enabling the detection of polyps and lesions indicative of CRC (Johnson et al., 2008).

Studies, including those by Johnson CD et al. (2008) and Pickhardt PJ et al. (2003), have demonstrated the effectiveness of CT colonography in detecting colorectal polyps and cancers, showcasing its potential as a screening tool. The procedure involves the use of a CT scanner to produce 2D and 3D images of the colon, facilitating the identification of abnormalities (Johnson et al., 2008; Pickhardt et al., 2003).

One of the key advantages of CT colonography lies in its noninvasive nature, eliminating the need for sedation and offering a relatively more comfortable experience compared to traditional colonoscopies (Pickhardt et al., 2003). Additionally, it poses a lower risk of complications, making it an attractive option for individuals averse to invasive procedures (Kadari et al., 2022; Pickhardt et al., 2011). Its accuracy is superior sensitivity compared to conventional colonoscopy. CT colonography excels in detecting abnormalities, even those situated near obstructing lesions, providing accurate localisation, small polyps and staging of lesions. However, CT colonography faces certain limitations. It encounters challenges in identifying flat lesions and does not offer details regarding hyperemia or superficial mucosal erosion, areas where conventional colonoscopy outperforms CT colonography (Singh et al., 2015).

2.9 Colorectal Cancer (CRC) Screening in Malaysia

In Malaysia, opportunistic screening is widely used because of the absence of a comprehensive population-based screening programme CRC ((NCI), 2008; Syful et al.,

2015). The rate of change in the epidemiology of colorectal cancer in Malaysia necessitates prompt action to prevent colorectal cancer and detect the disease through screening at an early stage. A substantial proportion of the target population must receive high-quality interventions and strategies to achieve this objective.

The two primary policy documents pertaining to colorectal cancer (CRC) screening in Malaysia are the Clinical Practice Guideline for Management of Colorectal Carcinoma 2017 and the Implementation Guideline for CRC Screening in Malaysia 2014. A pilot implementation of a CRC screening programme was conducted in Malaysia from March 2012 to March 2013. This programme utilised qualitative immunochemical faecal occult blood testing (iFOBT) as the initial screening method, followed by a colonoscopy for further evaluation. The pilot programme was carried out in six states within Malaysia (Arunah et al., 2020). The primary aim of this screening programme was to identify pre-lesions and colorectal malignancies in the asymptomatic population between the ages of 50 and 70, with the goal of detecting them at the earliest possible stage. Subsequently, individuals who obtain positive results from the immunochemical faecal occult blood test (iFOBT) would be directed to undergo a colonoscopy at the nearest hospital associated with the Ministry of Health (MOH). Therefore, the findings of this study indicate that the use of iFOBT can be considered a viable screening method in the context of Malaysia. Based on the results obtained from the initial pilot implementation, the decision was made to extend the implementation of CRC screening on a national scale as an opportunistic screening programme in 2014.

Although colonoscopy is a precise and effective screening tool (Bernard Levin et al., 2008), the decision on which CRC screening programme should be implemented in the first place is based on the availability of resources, including skilled healthcare professionals, costs, and population preferences (Sung et al., 2015). Although not superior to colonoscopy, the effectiveness of faecal occult blood tests in detecting CRC and

reducing colorectal cancer-related mortality is well-established (Bernard Levin et al., 2008; Sung et al., 2015). Hence, prioritising colonoscopy for individuals with a greater risk of CRC may be a worthwhile approach to reduce the burden of CRC in Malaysia. Individuals with a positive noninvasive faecal occult blood test, a family history of colorectal cancer, and those with additional risk factors can be prioritised for early colonoscopy (Sung et al., 2015). The use of a risk-based algorithm can direct screening of high-risk individuals by colonoscopy, which permits a more efficient allocation of limited healthcare resources (Law et al., 2014; Sung et al., 2015; Yeoh et al., 2011).

2.10 Barriers and Facilitators to Colorectal Cancer (CRC) Screening

Several research studies were conducted to discover the particular barriers that delay people from participating in CRC screening tests. Individuals with negative feelings such as embarrassment, anxiety, disinterest, fear of cancer or screening, subjective perception of pain or danger about screening, lack of time, feeling healthy, apprehensions about the bowel preparation, laxatives, or insertion of a tube, and discomfort are less likely to participate in CRC screening programmes (Berkowitz et al., 2008; Gimeno-Garcia et al., 2009; K. McCaffery et al., 2003; Richard Stacy, 2008). A study in Spain identified that fear of CRC screening tests and embarrassment are the two main barriers contributing to lower participation (Gimeno-Garcia et al., 2009). Few studies have found pain or physical discomfort to be a barrier associated with CRC screening tests (Beeker et al., 2000; Donovan & Syngal, 1998; Jones, Devers, et al., 2010). A latest systematic review based on screening barriers among participants above 65 years found that the most frequently reported barriers associated with CRC screening were unpleasantness, discomfort, and a shortage of financial aid for CRC screening (I. Guessous et al., 2010). Another barrier associated with CRC screening is embarrassment (Greisinger et al., 2006; McCaffery et al., 2001; Rawl et al., 2012; Robb et al., 2008). Furthermore, the cost has been identified

as another barrier that negatively influences participation in CRC screening tests (Beeker et al., 2000; Jones, Woolf, et al., 2010).

In the UK, a research study was conducted on attitudes towards sigmoidoscopy screening and awareness of CRC. They found that the most important screening barrier varied between white and non-white participants. Among white participants, lack of time was the main limiting factor, whereas, in non-white attendees, embarrassment predominated. Attitudes have also varied depending on the socioeconomic position, with negative attitudes being overrepresented in lower socioeconomic and less educated groups (Lantz et al., 1994; K. McCaffery et al., 2003).

According to a study by Galal et al., (2016) more women reported fear of results, painful procedures, shyness, and lack of transportation as barriers to CRC screening. Despite the lack of symptoms, men cited insufficient awareness about CRC screening programmes, healthcare providers' limited knowledge of recommended tests, and concerns about screening costs as significant factors (Galal et al., 2016). Furthermore, Wong et al. applied a Health Belief Model to identify gender-specific predictors of CRC screening among Singaporeans. Fear about detecting the disease, fear of colonoscopy, embarrassment, and perception of colonoscopy as harmful have been cited as barriers to CRC screening by a significantly higher percentage of females than males (R. K. Wong et al., 2013).

A systematic assessment of barriers to CRC screening across Asian studies revealed an unfavourable impression of screening methods. Other than that, there are negative opinions on invasive procedures, such as endoscopic-based procedures. Other identified negative perceptions were fear, pain experienced or perceived pain towards screening procedures, feeling embarrassed, concern of damage to health, inconvenience, and lack of confidence in screening effectiveness (Bujang et al., 2021; Harmy et al., 2011b; Loh et al., 2013; Sung et al., 2015; Yusoff et al., 2012b).

Surprisingly, in a study by Berkowitz et al. (Berkowitz et al., 2008), the majority of participants, ranging from 65 to 89 years old, indicated that their healthcare provider did not suggest screening. Two additional studies conducted in Malaysia and one in the United States also reflected this trend, highlighting the absence of physician recommendations as a significant obstacle to CRC screening (Bujang et al., 2021; Ramanathan et al., 2022; Seeff et al., 2004).

2.11 Treatment and Survival Rate

Treatment of CRC involves three main options, including surgery, chemotherapy, and radiation therapy, either alone or as adjuvant treatment. Based on data from the National Cancer Database, most CRC patients are treated with a combination of therapies. Surgery is the most common component of the multi-modality treatment plan. Some treatment options have long-term side effects that can also alter the quality of life long term. Permanent ostomies, bladder problems, and bowel dysfunction are common. Recurrent cancers are also common with CRC (DeSantis et al., 2014).

Treatment for CRC depends on the extent of the cancer spread. The only curative strategy in treating CRC is complete surgical resection. Even though approximately 70–80% of patients are eligible for curative surgical resection at the time of diagnosis (Abulafi & Williams, 1994), five-year overall survival is only 50–60% (Gatta et al., 1998). Two out of three patients who undergo curative resection will experience local recurrence or distant metastases. In 85%, relapse is diagnosed within the first 2.5 years after surgery (Gill et al., 2004). From the diagnosis of metastatic disease, patients with advanced CRC have a median survival rate of only six months. During this period, many patients will suffer from severe physical and psychological tumour-associated symptoms that detract from their quality of life (Seymour et al., 1997). Therefore, systemic treatment of CRC seeks to prevent local recurrence or metastatic disease after complete surgical

resection (Adjuvant therapy). Also, systemic treatment aims to prolong survival, control symptoms, improve the quality of life in patients with metastatic disease (Palliative therapy), and increase relapse-free survival through preoperative treatment (Neoadjuvant therapy).

For invasive colorectal cancer, surgical resection of the tumour with adequate margins, removal of the regional lymph nodes, and restoration of the continuity of the gastrointestinal tract by anastomosis is the mainstay of treatment. A permanent colostomy is required for cases of low rectal cancer, whereas a temporary defunctioning colostomy may prevent leakage of a low colorectal anastomosis (Mahmoud N., 2004). Treatment may be directed at either cure or palliation, the latter being carried out to alleviate pain, obstruction, and blood loss (Roberts, 2008).

Depending on the site and stage of the tumour, surgical treatment may be supplemented by adjuvant chemotherapy or radiotherapy (the latter is primarily indicated for cancer of the rectum). Several chemotherapeutic options for treating colorectal cancer include fluorouracil, irinotecan, capecitabine, oxaliplatin, and cetuximab (Foubert et al., 2014).

2.12 Health promotions on cancer awareness

Globally, various public health interventions have been created, executed, and assessed to determine their effectiveness in improving timely cancer detection, diagnosis, and survival rates. Skinner et al. conducted an educational initiative called Learn, Share & Live aimed at enhancing breast cancer knowledge and screening participation among African-American women in a U.S. city. The programme involved small-group sessions led by a healthcare professional for thirty-two participants over three meetings. Results showed a significant improvement in participants' knowledge scores, which rose from 3.4 to 4.1 ($P = 0.001$), indicating a better understanding of breast cancer symptoms and

risk factors (Skinner et al., 2000). A health awareness campaign known as Check' Em Out was introduced in the United Kingdom to promote understanding of testicular cancer and advocate for self-examination. Information about TC was disseminated using shower gel sachets containing printed instructions for testicular self-examination, waterproof stickers, and posters positioned in shower cubicles and changing rooms at various locations such as workplaces, health clubs, and leisure centres. This initiative increased the median score of men's awareness of testicular cancer from 3 units before the campaign to 4 units after the campaign, while their practice of testicular self-examination (TSE) increased by 10% (McCullagh et al., 2005).

In 2008, another research team demonstrated Community Outreach and Internal Navigation Programmes through educational presentations to the African-American population by community health advocates in churches, workplaces, and schools to improve the breast cancer stage of diagnosis. This programme improved the diagnosis stage; stage 0 increased, and stage 4 decreased (Gabram et al., 2008). In addition, a computer-based interactive educational programme named "Skin-safe" was conducted in the United Kingdom to increase knowledge about malignant melanoma, including the risk of sun exposure, how to protect the skin, and early symptoms. As a result, this multimedia intervention programme increased by one unit in mean score for knowledge of malignant melanoma (Glazebrook et al., 2006).

The Pink Chain Campaign was a nationwide initiative in India that began by promoting breast cancer awareness. The campaign encompassed an educational initiative comprising educational talks and seminars held between 2011 and 2015 at women's colleges in different Indian states, namely Delhi, Mumbai, and Jaipur. This campaign demonstrated a notable augmentation in the awareness of breast cancer among the target participants. After the campaign, there was a significant improvement in knowledge of breast cancer symptoms and risk factors, with a rise of over 50% compared to pre-campaign levels.

Throughout its existence, the Pink Chain Campaign expanded its efforts to raise awareness about additional prevalent types of cancer, specifically cervical, lung, and head and neck cancers, utilising the same platform (Shankar et al., 2017).

In 2008, the Cambridge Health Alliance in the United States (Lasser et al., 2011), followed by the Japanese local Government in 2010 (Hirai et al., 2016) and the Korean Ministry of Health in 2014 (Hong & Kam, 2014), independently implemented interventions to promote the uptake of CRC screening among their respective populations. The intervention involved the distribution of brochures or letters, along with CRC screening kits, to the general public through mail. The mailed brochure or letter contained information about CRC screening, the screening procedure, the importance of early screening, and the detection of CRC. These campaigns led to a notable rise in CRC screening within their targeted populations.

2.12.1 Worldwide implementation and effectiveness of mass media cancer awareness-raising campaigns

There are numerous types of cancer-related health promotion campaigns. Research studies conducted across the globe have shown promising outcomes regarding the effectiveness of mass-media campaigns in promoting healthy behaviours (Noar, 2006; Wakefield et al., 2010). These campaigns have proven beneficial in enhancing knowledge about cancer, increasing screening rates, and facilitating early cancer diagnosis (MacKie et al., 2003; Wanzer et al., 2014). The mass-media comprises various communication channels that aim to disseminate information to a broad audience. These communication channels include television, radio, newspapers, billboards, posters, the Internet, and smart media devices such as smartphones, smart TVs, and tablets.

Mackie and team aimed to promote the practice of early detection of malignant melanoma through a poster and leaflet advertisement in the West of Scotland. Their

findings showed a decrease in patient delay from 34% to 8%, accompanied by a significant reduction in tumor thickness (MacKie et al., 2003). From 2011 to 2013, a media campaign titled "The Wes Bonny Testimonial Campaign" was implemented in New South Wales (NSW), primarily focusing on raising awareness about the risks associated with melanoma. The campaign predominantly utilised television as its primary communication medium. These campaigns aimed at reducing skin cancer morbidity and mortality were proven effective in mitigating the economic burden of skin cancer in NSW. The campaign's efficacy is evident in reducing morbidity and mortality rates related to skin cancer in NSW (Doran et al., 2016).

Wanzer et al. and Leander et al. conducted and evaluated the effectiveness of a mass-media campaign aimed at raising awareness of testicular cancer and retinoblastoma in the United States and Honduras, respectively. Both campaigns disseminated their messages through various modes of media communication, such as flyers, brochures, posters, television, and radio. Participants exposed to the campaigns showed increased awareness of TC, with mean scores rising from 7.28 to 7.49, while diagnosed cases of retinoblastoma declined notably from 75% to 35% (Leander et al., 2007; Wanzer et al., 2014)

Another study examined the impact of a mass-media campaign on the uptake of cervical cancer screening among the Victorian population. The campaign was developed and broadcast during the years 2004 and 2005 (Anderson et al., 2009). The study observed a notable 27% rise in cervical screening rates among women across the entire population during the designated campaign period. In 2007, another study was conducted in NSW to evaluate the impact of a television advertising campaign promoting cervical screening. The campaign seemingly succeeded in augmenting the screening rate to 22% among women in NSW (Morrell et al., 2010) as there was an increase in diagnostic investigation activity and a shift towards earlier-stage disease (Hiom, 2015). Although the campaign

indicated a rise in knowledge of breast cancer risk factors, symptoms, and screening methods, screening practice did not improve.

A comprehensive mass-media campaign, including television, radio, and newspapers, was implemented to improve awareness regarding oral cancer and assess the campaign's effectiveness in Nepal. The mass-media campaign proved to be a successful strategy in raising awareness about oral cancer within the Nepalese community (Shrestha & Rimal, 2018). In Malaysia, a mass-media campaign was conducted across two national television channels, TV3 and NTV7, to enhance public awareness of oral cancer. The impact assessment of this campaign showed that a significant proportion of participants were able to identify at least one symptom of oral cancer correctly. The participants also reported obtaining this information from television advertisements (Saleh et al., 2012). Therefore, it has been concluded that television advertising continues to be an effective method for educating the general public about oral cancer.

2.12.2 Worldwide implementation and effectiveness of mass media colorectal cancer (CRC) awareness-raising campaigns

Worldwide, public health or non-government organisations (NGOs) have developed and implemented a few media CRC awareness-raising campaigns to improve CRC's early presentation and diagnosis. Globally, most CRC media campaigns primarily emphasise CRC screening rather than educating on symptoms or promoting early detection. Only a limited number of awareness campaigns primarily emphasise the symptoms associated with CRC. The majority of public awareness campaigns are executed in accordance with National Colorectal Cancer Awareness Month.

Since 2017, the Chris4Life Colon Cancer Foundation and the Colorectal Cancer Alliance (NGOs) have joined together to create awareness of CRC through a media campaign named "Don't Assume" ((CCA), 2019). The primary goal of this campaign was

to challenge the assumptions and misconceptions about CRC by dispelling myths, raising awareness, and connecting people across the country with information and support. The comprehensive social media toolkit on the campaign's website encompasses all the information generated by the team for the CRC awareness campaign, including images and messages. The American Society of Colon and Rectal Surgeons (ASCRS) (NGO) also has initiatives to raise awareness of CRC through social media platforms, organising educational seminars, and featuring stories of CRC survivors in their Patient Success Stories collection. The primary objective of ASCRS is to educate the community regarding CRC and improve awareness about the importance of CRC screening, prevention, and treatment (as stated on the organisation's website) (ASCRS, 2017). In 2015, the International Cancer Control Partnership (NGO) also executed a media campaign named "Avoid Colon Cancer" focused on CRC. The team created a YouTube video aimed at raising awareness about CRC screening. This campaign video encourages the uptake of CRC screening and early detection of CRC among the population of Spain (ICCP, 2015). Furthermore, it is essential to note that no extensive assessment was carried out on the campaign's effectiveness. This is a gap in our knowledge, as we are currently unable to definitively conclude whether these campaigns effectively enhance public awareness of CRC.

The Screen for Life: National Colorectal Cancer Action Campaign by the U.S. Department of Health and Human Services focuses on CRC screening. The campaign messages were disseminated through various forms of media, including television, radio, and printed materials. The campaign consistently demonstrated a notable increase in the level of participation in screenings among the targeted population (CDCP, 1999). In addition, since 2007, the Korean Society of Coloproctology implemented a social networking service (metaverse and Twitter) titled the "Gold Ribbon Campaign." Their campaign aimed to enhance public knowledge regarding symptoms associated with early-

onset colorectal cancer (CRC), and they effectively accomplished this goal (Lee et al., 2016; Lee et al., 2023).

The "Be Clear on Cancer" (BCOC) initiative was implemented in England in 2011, whereas the "Be Cancer Aware Programme" (BeCAP) was developed and implemented by the Public Health Agency (PHA) of Northern Ireland (NI) in 2014 (PHA, 2015b). The evaluation results revealed a noticeable improvement in the level of knowledge regarding cancer symptoms and a rise in the number of clinic visits among patients who reported experiencing symptoms associated with the campaign. Moreover, a higher proportion of individuals residing in the areas of campaign implementation were immediately referred by healthcare practitioners because of suspected CRC.

Table 2.1: Summary of Colorectal Cancer Awareness Media Campaign Worldwide

Type of Campaign	Campaign Name/ Organiser	Campaign Target	Campaign Effectiveness
Social Media (Facebook, Twitter, YouTube, Website)	American Society of Colon and Rectal Surgeons	CRC Screening Awareness	Was not assessed
	Don't Assume	CRC Screening Awareness	Was not assessed
	The Screen for Life: National Colorectal Cancer Action Campaign	1) CRC Screening Awareness	Successfully increased awareness of CRC screening
	Gold Ribbon Campaign	Awareness of CRC symptom	Successfully increased awareness of CRC screening
	Avoid colon cancer	CRC Screening Awareness	Was not assessed
	Be Cancer Aware	1) Awareness of CRC symptom 2) CRC Screening Awareness	Successfully increased awareness of CRC symptoms and CRC screening.

Table 2.1: Continued

Mass-Media (TV, Radio, Posters)	The Screen for Life: National Colorectal Cancer Action Campaign	1) CRC Screening Awareness	Successfully increased awareness of CRC screening.
	Be Clear On Cancer	1) Awareness of CRC symptom 2) CRC Screening Awareness	Successfully increased awareness of CRC symptoms and CRC screening.
	Be Cancer Aware	1) Awareness of CRC symptom 2) CRC Screening Awareness	Successfully increased awareness of CRC symptoms and CRC screening.

2.12.3 Implementation and effectiveness of CRC awareness campaigns in Malaysia

In Malaysia, the Ministry of Health (MOH) and non-governmental organisations (NGOs) have conducted a limited number of awareness campaigns explicitly targeting colorectal cancer (CRC). As stated in section 2.12, most CRC campaigns primarily promoted and implemented CRC screening initiatives (Loh et al., 2017; Oommen, 1994). Furthermore, Malaysia has not documented any specific campaign targeting CRC symptoms for early detection nor preventive measures to reduce the recurrence rate and improve cancer control. Thus, there is a lack of reported effectiveness and outcome measures used in CRC awareness campaigns in Malaysia (Loh et al., 2017). Due to the escalating CRC rates and delayed diagnosis in Malaysia, developing a campaign grounded in research and tailored to the country's specific needs is necessary. The primary objective of this campaign would be to enhance public awareness regarding cancer symptoms, thereby promoting early detection, reducing disease progression, and ultimately improving treatment (Hashim et al., 2010; Hilmi et al., 2010a; Su et al., 2013a).

Empowered is a non-governmental organisation of The Cancer Advocacy Society in Malaysia, which has focused on colorectal since 2011 and has an annual awareness event. Their main aim is to provide more cancer education on CRC early detection, screening programmes, and personalised support in the homes and communities of low-income

Malaysians. Similarly, the KeepAble Cancer Community (NGO) in Petaling Jaya, Selangor, has strongly emphasised three community themes since 2014: being active, eating a healthy plant-based diet, aiming for a healthy weight, and living a healthy lifestyle for cancer survivors. The primary objectives of the community centre were to assist individuals who have overcome cancer, raise public awareness about cancer, and foster community involvement in cancer-related initiatives. All of the initiatives organised by KeepAble were conducted exclusively within the premises of their cancer community centre. In addition to disseminating knowledge about CRC awareness, the centre also offered faecal immunochemical tests (FIT) as a means of screening for CRC (Loh et al., 2017).

Yakult (M) Sdn Bhd conducted a public campaign at the Mutiara Damansara clinic in 2015. The campaign's primary objectives were to enhance public awareness regarding symptoms associated with CRC and to encourage CRC screening practices. This was effectively conveyed through the campaign's slogan, ''Colorectal Cancer Is Preventable.'' Similarly, in 2016, the administration of Hospital Duchess of Kent, Sabah, conducted a public campaign at their hospital. This campaign's slogan was "“Early Detection Saves Lives,"" and its primary objective was to raise awareness of CRC symptoms.

According to the data presented in Table 2.1, the Be Cancer Aware (BCA) campaign was implemented by the Public Health Agency in Northern Ireland (PHA NI) in the year 2015. The BCA campaign is an effective mass- media initiative to raise awareness about CRC, resulting in heightened knowledge regarding CRC symptoms and screening. Furthermore, according to the data presented in Table 2.2, it is evident that Malaysia did not have any mass- media campaigns aimed at raising awareness about the CRC. Implementing a mass- media campaign to raise awareness about CRC is of utmost importance for the Malaysian population. As such, his study serves as an intervention to

enhance their knowledge, attitudes, and beliefs towards CRC. The chosen intervention will undergo a process of validation and cultural adaptation prior to its implementation. Chapter 3 provides a comprehensive description of the entire process of cultural adaptation.

Table 2.2: Summary of Colorectal Cancer (CRC) Awareness campaigns in Malaysia

Type of Campaign	Campaign Name/ Organiser	Campaign Target	Campaign Effectiveness
Public Campaign	Empowered, The Cancer Advocacy Society of Malaysia	CRC Screening Awareness	Was not assessed
	Keepable Cancer Community	CRC Screening Awareness	Was not assessed
	Yakult (M) Sdn Bhd	1) Awareness of CRC symptom 2) CRC Screening Awareness	Was not assessed
	Hospital Duchess of Kent	Awareness of CRC symptom	Was not assessed

2.12.4 The Be Cancer Aware Campaign

Be Cancer Aware (BCA) is a mass media cancer awareness campaign developed and implemented in 2015 by the Public Health Agency in Northern Ireland (PHA NI). The campaign's primary objective was to increase public awareness of cancer symptoms and urge individuals to discuss their symptoms with healthcare professionals as soon as possible. Their campaign materials highlight the importance of being aware of cancer's common symptoms and encourage anyone who notices any unexplained changes to their body to make an appointment with the doctor (PHA, 2015a). This is important as earlier detection of cancer makes treatment easier. The first phase of the Be Cancer Aware campaign included television, radio, online, and press advertising throughout Northern Ireland.

BCA campaign mainly focused on general symptoms of breast, lung, and colorectal cancer. Examples of symptoms include unusual lumps (breast cancer), coughing for more than three weeks (lung cancer), and abnormal bleeding (colorectal cancer). Their awareness campaign included a television commercial, a radio commercial, printed posters (outdoor poster/billboard, healthcare setting, and newspaper advertising), printed leaflets (magazines), and social media (Website and Facebook) (PHA, 2015a).

Findings from the post-BCA campaign revealed that 1-2 out of 10 respondents agreed that they would not want to know if they had cancer. In addition, 9 out of 10 respondents decided that going to the doctor as quickly as possible after noticing a symptom of cancer could increase the chances of survival. Besides that, the rate of urgent breast cancer referrals improved by 50%, and the cancer detection rate rose by 44% during the campaign time compared to the previous year's campaign (Public Health Agency & Aware, 2016). This increase was also found in Scottish and English breast cancer campaigns (Public Health Agency & Aware, 2016).

BCA is not the first campaign on awareness of CRC symptoms conducted by the Public Health Agency. In 2014, they organised an ovarian cancer awareness campaign in Northern Ireland following successful lobbying by ovarian cancer campaigner Una Crudden. In conjunction with the success of the ovarian cancer awareness campaign, the Public Health Agency continued to launch the BCA campaign and successfully conducted it (PHA, 2015a).

2.13 Cultural Adaptation of Health Promotion Intervention

Cultural adaptation of evidence-based interventions is a key strategy for addressing health disparities that may exist among different populations. Health disparities refer to health outcomes or access to healthcare services, often based on social and economic factors, such as race or ethnicity, socioeconomic status, or geographic location. This

adaptation process will reduce health disparities by developing more relevant and acceptable interventions for diverse populations (Rockville, 2019). By adapting interventions to be culturally appropriate, they are more likely to be accepted and effective among populations that may face barriers to accessing healthcare or experience a lower quality of care (Handtke et al., 2019).

Cultural adaptations of evidence-based interventions entail customising the interventions to align with the cultural context, beliefs, and values of a particular population while preserving the fundamental components of the original intervention that have proven effective in various environments. These adaptations play a critical role in enhancing the acceptability, accessibility, and effectiveness of interventions, particularly when working with diverse ethnic groups (Nair & Adetayo, 2019).

Cultural adaptation typically involves a systematic process that includes identifying the target population's cultural norms, beliefs, values, language and literacy, and unique social and economic contexts (Marsiglia & Booth, 2015). For example, interventions may need to consider the role of family or community in decision-making or healing practices that are important in the culture. Adapting culturally relevant interventions can help promote positive health behaviours and outcomes among diverse populations. This adaptation process involves conducting focus group discussions, interviews, and surveys with participants of the targeted population and consulting with cultural experts to ensure the intervention is culturally appropriate and effective (Domenech Rodríguez et al., 2011).

Cultural adaptation of evidence-based interventions is essential for reducing health disparities and promoting health equity. Tailoring interventions to the target population's unique needs and cultural context can improve health outcomes and reduce healthcare access and utilisation disparities.

2.13.1 Heuristic Framework

There are several models to guide cultural adaptations that have been proposed by a few researchers (Barrera Jr. & Castro, 2006; Domenech Rodríguez & Wieling, 2004; Kumpfer et al., 2008; McKleroy et al., 2006; Wingood & DiClemente, 2008). One is known as a Heuristic Framework, which Barrera and his team developed to guide the process of adapting evidence-based interventions better to fit a target population's cultural needs and preferences(Barrera Jr. & Castro, 2006). This model involves a systematic approach that helps to ensure that cultural adaptations are appropriate, effective, and sustainable. Barrera and his team have proposed a sequence of five intervention adaptation stages consisting of (a) information gathering, (b) preliminary adaptation design, (c) preliminary adaptation tests, (d) adaptation refinement, and (e) adaptation trial (Barrera Jr. & Castro, 2006).

The five stages of the Heuristic Framework are explained below (Barrera Jr. & Castro, 2006):-

Information gathering: The first step involves collecting information about the target population's cultural beliefs, values, and practices. This can be done through literature reviews, focus groups, interviews, and other forms of data collection. The goal is to understand the cultural context in which the intervention will be delivered.

Preliminary adaptation design: Based on the information gathered in the first step, the intervention is adapted to better fit the cultural needs and preferences of the target population. This can involve modifying the intervention materials, activities, or delivery methods. For example, if the intervention was originally developed in English, but the target population speaks another language, the materials may need to be translated.

Preliminary adaptation test: The adapted intervention is then tested with a small group of individuals from the target population to assess its feasibility and acceptability.

Feedback is collected and used to refine the intervention further. This can involve conducting focus groups, surveys, or interviews to gather feedback.

Adaptation refinement: Based on the feedback from the preliminary adaptation test, the intervention is refined better to meet the needs and preferences of the target population. This may involve modifying the intervention materials, activities, or delivery methods.

Adaptation trial: The adapted intervention is then tested with a larger group of individuals from the target population to assess its effectiveness in promoting desired health outcomes. This can involve conducting a randomised controlled trial or another type of research study to evaluate the intervention's effectiveness.

The cultural adaptation of the Heuristic Framework emphasises the importance of involving members of the target population in the adaptation process and using a systematic approach to ensure that cultural adaptations are appropriate and effective. By following this framework, intervention developers can ensure that their interventions are culturally appropriate and have the potential to promote health outcomes among diverse populations effectively.

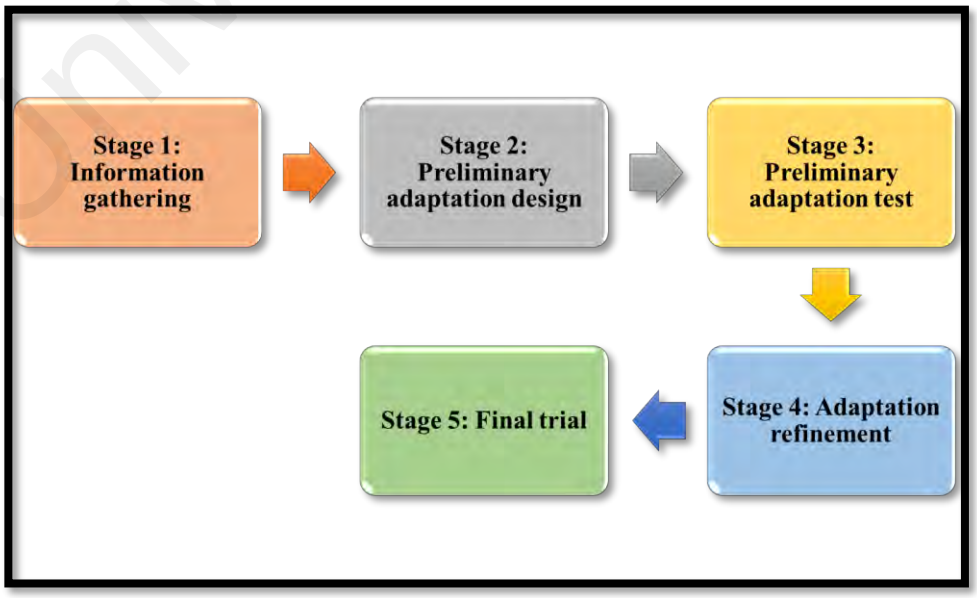

Figure 2.5: Heuristic Framework (Barrera Jr. & Castro, 2006)

2.14 Theoretical Framework

A mass-media health awareness campaign's primary goal is to change the community's attitudes, societal behaviour, and perceptions of traditional and social norms (Wakefield et al., 2010). Evidence indicates that theoretical framework-based research is necessary for predicting human behaviour, including changes in awareness knowledge, beliefs about cancer, beliefs about cancer screening, and help-seeking behaviour, particularly for CRC (Bloomfield, 2015). The ability to recognise and identify the theoretical frameworks and relevant constructs adopted to predict and enhance human behaviour will facilitate the development and implementation of more effective theory-based intervention programmes. Additionally, it will maximise the efficiency of the intended campaign (Bloomfield, 2015). In Malaysia, a lack of knowledge, psychosocial factors, inadequate implementation of CRC-related campaigns, and physician recommendations on CRC screening impede participation in CRC screening programmes and early detection (Doraimuthu et al., 2023).

A literature review of the health theories applied for the past five years (2017 -2021) revealed that the "Health Belief Model," "Theoretical Domains Framework & COM-B Model," "Self-regulation Model," "Theory of Planned Behaviour with cultural competency theory," "Action control framework" and "Informed decision-making and health literacy skills framework" theories were applied as the ground for the colorectal cancer screening programmes. The Health Belief Model, the Theory of Reasoned Action, and the Theory of Planned Behaviour are the most widely used theories relevant to the subject matter (Kiviniemi et al., 2011). Each theory is commonly used to explain why an individual will execute a specific behaviour as well as how that individual may justify their rationale for the behaviour. In addition, two additional studies used "Andersen's Behavioural Model" to determine the factors that contribute to CRC screening.

The Health Belief Model (HBM) (Rosenstock & Charles, 1974) has been one of the most widely used behavioural theories since its introduction over 50 years ago (Orji et al., 2012). HBM was initially conceptualised to explain preventive health behaviour. In this sense, "health behaviour" is a specific term used to demarcate activity by a person who perceives him or herself to be currently healthy "to prevent disease or detect disease in an asymptomatic stage" (Rosenstock & Charles, 1974). Since its initial application, the HBM has been extended to evaluate public health behaviours beyond prevention to responses to symptoms and diagnoses as well as medical adherence (Champion & Skinner, 2008). The fundamental model includes four core constructs of perception that are integrated to predict health behaviour: perceived benefits, perceived barriers, perceived susceptibility, and perceived severity.

The Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975; Heilbroner et al., 1980) is also widely used and is the fundamental theory associated with the Reasoned Action Approach (RAA) family of behavioural theories (Head & Noar, 2014). The primary tenant of the TRA is that "behavioural intentions, which are the immediate antecedents to behaviour, are a function of salient information or beliefs about the likelihood that performing a particular behaviour will lead to a specific outcome" (Madden et al., 1992). Within the TRA, two primary categories of beliefs influence behavioural intention: attitudes towards the behaviour and subjective norms. This theory considers the factors that influence CRC information-seeking behaviours, and while our campaign mainly considers awareness of CRC symptoms, it might not be directly applicable.

The theory of planned behaviour includes the constructs of attitudes, subjective norms, and perceived behavioural control, which leads to the intention to follow healthy behaviour and foster healthy behaviour (Ajzen, 1991). This theory is mainly applied to

predict CRC screening uptake in the community. Therefore, we excluded it from using it as a theoretical model in our BCAC-BC intervention.

Andersen's Model was conceptualised to demonstrate the factors that lead to the use of healthcare services (Andersen, 1995). According to the model, utilisation of health services includes inpatient care, doctor visits, dental care, and others. The model contains three key components such as predisposing, enabling, and need-for-care factors, which either facilitate or impede the utilisation of services by individuals. Predisposing factors include sociodemographic variables (age, gender, marital status, and education), knowledge about CRC (symptoms and risk factors), belief about cancer, belief about CRC screening, and CRC screening history. Enabling factors include socioeconomic variables (occupation and household income) and exposure to the BCAC-CRC campaign. Need for care factors have the perceived need for CRC (knowledge about cancer and belief about cancer), the perceived need for CRC screening (belief about CRC screening), and CRC history. The outcome is the duration of a healthcare provider visit with CRC symptom recognition. The theoretical framework of Andersen's behavioural model is presented in Figure 2.6.

This study was developed based on Andersen's behavioural model and hypothesised that delivering information on CRC awareness and screening through mass-media campaigns could improve an individual's perceived susceptibility and seriousness of CRC, understand the importance of early CRC screening and detection, and reduce negative beliefs about CRC screening.

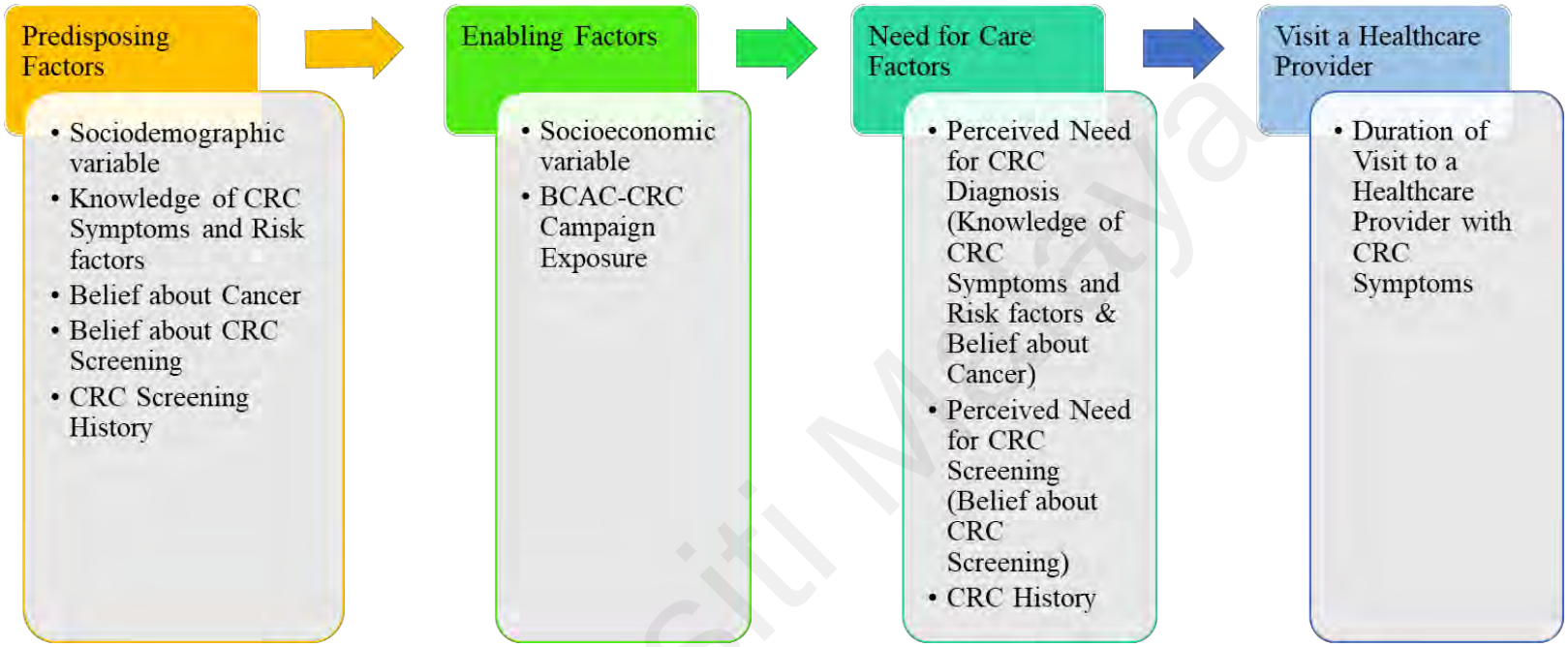

Figure 2.6: Theoretical Framework Adapted from Andersen's behavioral model (Andersen, 1995)

2.15 Conceptual Framework of the Study

The knowledge, attitudes, and beliefs of Malaysians about colorectal cancer and screening can affect their healthcare-seeking behaviour. To address this, a mass-media campaign based on the Heuristic framework (Barrera Jr. & Castro, 2006) has been developed as an intervention, using Andersen's behavioural model (Andersen et al., 2007) as a theoretical framework. The model proposes that health-seeking behaviour is influenced by three factors: predisposing characteristics, enabling factors, and perceived need. It assumes that an individual's decision to seek healthcare services is a sequential and conditional process based on their predisposition to use health services, their ability to access those services, and their perceived need for them.

The likelihood of a person seeking healthcare services is influenced by predisposing factors such as their sociodemographic characteristics, family and friends with a history of colorectal cancer (CRC), and their own history of CRC screening. Enabling factors refer to the resources and support systems available to an individual, which can either facilitate or hinder their access to healthcare. This includes their socioeconomic characteristics and exposure to the BCAC-CRC campaign. The campaign falls under the enabling factor category, as it helps participants to gain knowledge about CRC and develop a positive belief about cancer and CRC screening. Need factors are related to an individual's perceived need for healthcare services and include both the perceived need for CRC diagnosis (knowledge of CRC symptoms and risk factors, and belief about cancer) and the perceived need for CRC screening (belief about CRC screening). The greater the perceived need, the more likely an individual is to use healthcare services. The conceptual framework of this study is illustrated in Figure 2.7.

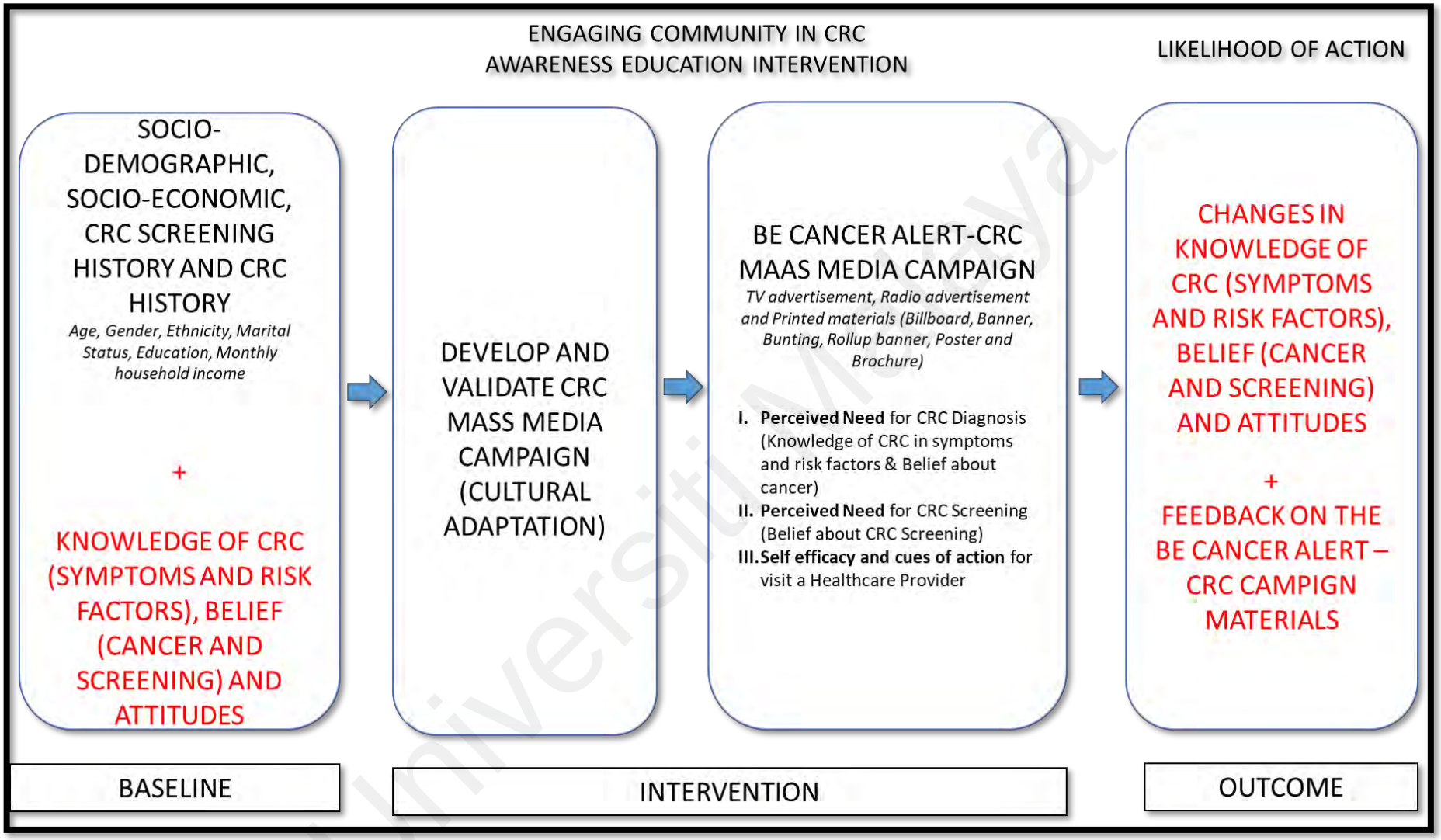

Figure 2.7: Conceptual Framework of the Study

CHAPTER 3: METHODOLOGY

3.1 Introduction of this chapter

This chapter presents the research principles followed during the study. The research involved three phases: Phase 1 was a systematic review focused on the awareness and barriers of Malaysians towards CRC screening. Phase 2 involved the development of a heuristic framework to adapt and culturally tailor a mass-media campaign. Phase 3 was a longitudinal study to evaluate the implementation of the mass-media campaign.

To explain the methodology used, the chapter is divided into six sections, one for each phase. Each section covers study design, study population, study area, sample size estimation, sampling method, study instruments, data collection process, and data management and analysis. The second section explains Phase 1, which is the systematic review. The third section explains Phase 2, which describes the heuristic framework. The fourth section explains Phase 3, which was the longitudinal study and consists of three subsections: pre-campaign household survey, campaign implementation, and post-campaign household survey. The fifth section describes the data management and analysis. Finally, the sixth section highlights the ethical considerations of the study.

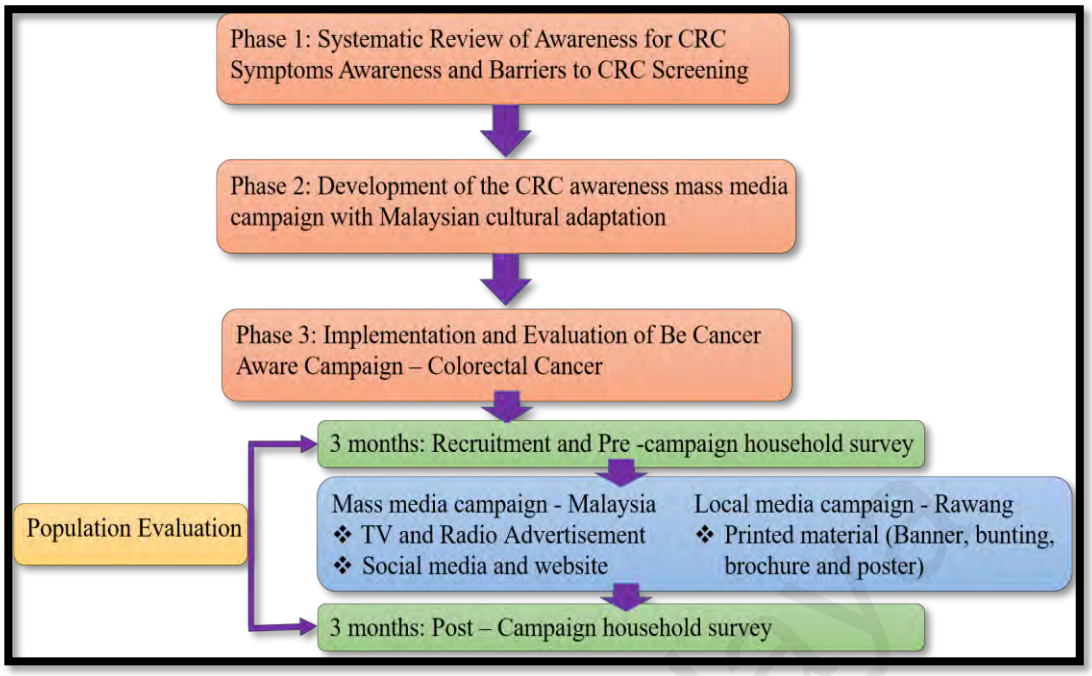

Figure 3.1: Study flow chart

3.2 Phase 1: Systematic Review of Awareness of Colorectal Cancer (CRC) Symptoms and Barriers to Colorectal Cancer Screening among Malaysians

3.2.1 Systematic Review

A review protocol that takes into account the search strategy, study selection, and data extraction was drafted. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) were referred to as formal guidelines for the systematic review. This systematic review aimed to identify and appraise studies that assessed the awareness of CRC symptoms and barriers to CRC screening among Malaysians.

3.2.2 Search Strategies

The following electronic databases were searched: MEDLINE, Embase, CINAHL, Web of Science, PsycINFO, Scopus, and Cochrane Library, restricted to articles in English, publication year from January 2008 to August 2023. Grey literature was searched in Google Scholar, and reference lists of relevant studies were hand-searched. The following main keywords were used for the search: (I) knowledge; symptoms; barriers;

attitude; belief; perception; screening; colonoscopy OR faecal occult blood test (FOBT); AND (II) colorectal cancer; colon cancer; colorectal tumour OR colorectal carcinoma; AND (III) Malaysia. The search string was created and generated using Boolean operators and keyword search (Appendix A). The search strategy was developed a priori and registered with the International Prospective Register of Systematic Reviews (PROSPERO) (*National Institute of Health Research: PROSPERO*, 2018).

3.2.3 Selection of articles

The process of selecting articles was carried out in three steps. The researcher conducted all the searches for articles and saved the details of the chosen studies in the EndNote X9 software. This software was then used to screen and delete any duplicated studies. In the second step, the researcher, two supervisors, and a postdoctoral independently selected article based on their title and abstract, except for the duplicated articles that were excluded earlier. The articles that were excluded by the reviewers were agreed upon through consensus. In the third step, the remaining full-text articles were retrieved if they met the inclusion criteria.

3.2.4 Inclusion and Exclusion Criteria

The following inclusion criteria were applied for selecting the full-text articles.

i) Types of Participants

   Adults aged 18 years and above who were Malaysian

ii) Type of Studies

   Quantitative and qualitative studies published in a peer-reviewed journal.

iii) Year of Publication

   Full articles were published in journals for the past 15 years (January 2008 - June 2023)

iv) Language

All the articles were peer-reviewed and published in the English language

v) Finding

All the articles reported the awareness of colorectal cancer symptoms AND/OR barriers to CRC screening.

The following exclusion criteria were applied for selecting the full-text articles.

i) Types of Participants

Malaysian adults living elsewhere, patients with diagnosed cancer, and family members of cancer patients

ii) Type of Studies

All the systematic reviews & meta-analyses, reviews, protocols, and general reports, including conference proceedings, if sufficient details could not be obtained

iii) Finding

All of the reported articles assessed intervention studies and studies focusing on cancer in general or other cancer types besides CRC.

3.2.5 Data Extraction

The data for the research study was extracted using a pre-designed data extraction form. The extracted data was then reviewed by a postdoctoral and two supervisors. Any disagreements in the data extraction process were resolved through discussion until a consensus was reached. The extracted data included the following information: study design, study population, study setting, sample size, survey tool, type of cancer, measured outcome (symptom awareness and barriers to CRC screening), outcomes, and recommendations. The results of quantitative studies were reported as percentages for each symptom and barrier, i.e., awareness of CRC symptoms and barriers to cancer

screening. The results of qualitative studies were reported as a list for each symptom and barrier, i.e., awareness of CRC symptoms and barriers to cancer screening.

3.2.6 Criteria for Quality Appraisal of Selected Studies

Thirteen articles (12 quantitative and 1 qualitative) were rated for data quality. The Joanna Briggs Institute (JBI) Critical Appraisal Tool was used as the assessment tool for cross-sectional studies and qualitative studies. The JBI Critical Appraisal Tool Checklist contains eight questions for cross-sectional (Moola S & Lisy K, 2017) and ten questions for qualitative studies (Lockwood et al., 2015). Scores were assigned to responses to each question as "Yes" = 1, meanwhile "No," "Not Applicable," and "Unclear" = 0. The maximum total scores for any study were 8 for cross-sectional studies and 10 for qualitative studies. A priori, it was decided that the study quality was evaluated and classified as a JBI score higher than 70% as having a high quality, those with a score between 50% to 70% as having a medium quality, and those with a score less than 50% as having a low quality (Pimsen et al., 2022). The tools used to assess the quality of the selected articles are attached in Appendix B and Appendix C.

The researcher, postdoctoral, and supervisors carried out the quality assessment independently. In the event of disagreement, the researcher discussed the matter with the supervisors and postdoctoral to decide which score was more appropriate.

3.3 Phase 2: Development of the CRC awareness mass media campaign with Malaysian cultural adaptation

Phase 2 was to develop the CRC awareness mass-media campaign with emphasising element of cultural adaptation in Malaysia. The cultural adaptation for the campaign materials was required to suit the Malaysian population's cultural needs and preferences. The process of cultural adaptation is guided by Barrera and Castro's heuristic framework

(Barrera Jr. & Castro, 2006; Barrera et al., 2013). This heuristic framework is a systematic procedure to ensure that cultural adaptations are appropriate, effective, and sustainable. The development and adaptation of a cultural adaptation mass-media campaign to promote awareness of CRC in Malaysia involved several stages. The following flowchart summarises the stages involved in the development of culturally adapted awareness-raising mass-media campaign material and design.

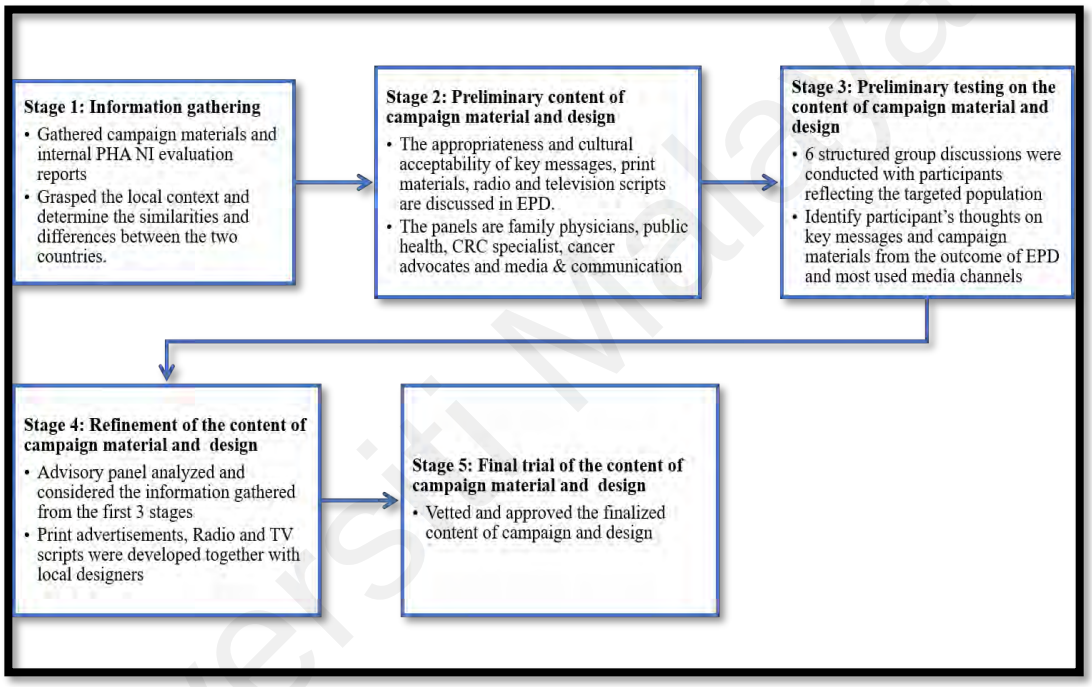

Figure 3.2: Flow chart of stages involved in the development of culturally adapted the CRC awareness campaign

3.3.1 Stage 1: Information gathering

Researchers from Queen's University Belfast (QUB) and the Universiti Malaya (UM) met with programme coordinators from the Public Health Agency Northern Ireland (PHA NI) to collect data for the Be Cancer Aware (BCA) campaign. The aim of the meeting was to gather information related to the campaign's development, implementation, and evaluation. The PHA NI provided campaign materials and internal evaluation reports, including reports on the colorectal cancer campaign and the BCA evaluation report.

Research workshops were conducted by panel members from both countries to understand the local context and identify similarities and differences in the healthcare systems and target populations. This process helped the research team identify discrepancies among the target populations.

3.3.2 Stage 2: Preliminary content of campaign material and design

3.3.2.1 Study Population

The study involved a diverse group of participants who are involved in cancer awareness, prevention, and control in Malaysia. These participants include public health advocates, media and communication experts, family physicians, language and linguistic experts, and cancer advocates at federal, state, and university levels.

At the national level, the study included the Public Health Physician & Senior Principal Assistant Director (Head of the Cancer Unit) Noncommunicable Disease Sector from the Ministry of Health in Malaysia. At the state level, family physicians from Government Health Clinics in Selangor from the Ministry of Health in Malaysia were included. At the university level, public health advocates as well as language and linguistic experts from the University Malaya, including the Head of the Health & Communication Research Group from The University Kebangsaan Malaysia, were included.

Cancer advocates from the National Cancer Society Malaysia (NCSM) were also included. Media and communication experts such as the Executive Director & Principal Consultant of Perception Management and Head of Operations & Presenter of The Business Station (BFM) Media were also part of the study.

The study aimed to examine the issue of noncommunicable diseases, particularly cancer prevention and control, and the selected sample of participants could be generalised to all cancer advocates and healthcare providers in Malaysia. The experts

were fluent native speakers of the four main languages such as Malay, English, Cantonese, and Tamil.

3.3.2.2 Sampling

A purposive expert-based sampling (Crossman, 2023; Palys, 2008) was used to select the participants from different fields for this expert panel discussion (EPD). This sampling method enabled the selection of experts or stakeholders as participants in the study; in this case, experts from various fields (mentioned in the section on the study population) who were able to provide feedback on the clarity and acceptability of each campaign's materials as well as recommendations for further improvement.

Approximately six respondents (n = 6) were required to reach data saturation for the present EPD. This sample size is adequate and backed by a review paper and a similar topic article, whereby the reported average sample size to reach data saturation was between 3 to 54 respondents (George et al., 2018; Vasileiou et al., 2018).

The numbers of participants from the following areas: family physicians (n = 3), public health specialists (n = 4), language and linguistic (n = 1), cancer advocates (n = 4), and media and communication (n = 5). After the discussion session with 17 experts, I decided that the information collected was sufficient to address the study objective.

3.3.2.3 Expert Panel Discussion Guide

In accordance with the study's objective, a semi-structured in-depth discussion known as Expert Panel Discussion (EPD) was conducted to explore whether the content of all the BCA campaign materials is culturally appropriate and acceptable to Malaysians. The adapted Be Cancer Aware (BCA) campaign material content, including key messages, printed materials, and radio and TV scripts, was a primarily focused topic of discussion.

To help steer the conversation towards achieving the study objective, a semi-structured EPD guide was created with questions related to the objective, as shown in Appendix D. The guide was developed while taking into account the appropriateness and cultural acceptability of colorectal cancer (CRC) awareness-raising mass-media campaign materials such as key messages, printed materials, and radio and TV scripts that are relevant to the Malaysian context. This guide helps the interviewer by providing a framework and prompting relevant points from the interviewee when necessary. The EPD guides were created in English, and the principal investigator and Post-doc reviewed the guide for content validity to ensure the collection of valuable data.

3.3.2.4 Expert Panel Discussion (EPD)

Expert panel discussion (EPD) was conducted throughout the whole day on August 2017. An expert panel discussion technique involving face-to-face interaction with experts was conducted for data collection. This technique was selected because it was the most appropriate in exploring our experts' cultural acceptability and experience on the CRC awareness-raising mass-media campaign materials such as key messages, printed materials, and radio and TV scripts.

The data collection process began by sending all the selected experts a letter of invitation. Additionally, experts were given detailed information regarding the purpose of the research and their involvement during the discussion session. Subsequently, discussions were carried out according to the date all participants agreed.

The discussion begins with a 10-minute ice-breaking session to build rapport with the experts; this process involves self-introduction on both sides. Once the researcher felt that the respondent is ready, the session will be started with a briefing on the purpose, procedures, and potential benefits and risks of the study before obtaining verbal consent. I also clarified the duration of the discussion session and audio recording and noted salient

points during the session. Once an agreement had been obtained, the discussion was conducted in English.

The discussion was recorded using an audio recorder upon receiving the expert's permission. In addition, salient points were noted during the discussion. A portable "Sony" voice recorder was used to audiotape the interview sessions. This device has features (direct connection digital recorder with 2GB built-in memory, an MP3 stereo recorder, and PC data storage capability) that were appropriate for use in this part of the study ("Sony ICDUX81F 2GB Direct USB MP3 Notetaker"). The voice recorder was placed in the middle of the round table to capture the best recording quality. The discussion session took around 1 hour and 30 minutes.

The experts were asked for opinions based on the semi-structured EPD guide. However, they were free to discuss other CRC-related issues that underlined the study objective. At the end of the discussion session, they were reminded to express any other matters they thought would improve the campaign materials. In addition, a summary was made to verify their suggestion on adapting campaign material as a conclusion. This summary was counter-checked with the experts, which functioned as a validation process of the discussion. Straight after the discussion session, time was allocated to note a few points regarding the discussion.

3.3.2.5 Transcribing

The audio recordings of the discussion were then completely verbatim transcribed and then destroyed. Professional transcribers performed transcriptions of the discussion audio. To ensure accuracy, the investigator proofread the transcriptions and cross-checked them with a Post-doc based on the voice recording.

3.3.3 Stage 3: Preliminary testing on the content of campaign material and design

3.3.3.1 Study Population

Study participants for this stage are drawn from major ethnic groups such as Malays, Chinese, and Indians in Malaysia and from low and middle-income backgrounds. In addition, participants are also reflecting the targeted population of Malaysians aged 40 years and above. This is because the risk of colorectal cancer (CRC) increases gradually after age 40 and then drastically after age 50. All participants had to be fluent and understand English or Malay, but it did not have to be their native language.

3.3.3.2 Sampling

The participants for this stage were recruited using a purposive homogeneous-based sampling technique. By selecting participants with shared characteristics or experiences, researchers can better understand their perspectives, behaviours, and contexts, resulting in more insightful and information-rich findings (Thomas, 2022).

A structured group discussion (GD) needs to be small enough to allow everyone to express an opinion (Basu et al., 2006). On the other hand, it also should be large enough to generate rich discussion and provide a diversity of views (Dilshad & Latif, 2013). In addition, more than three to four focus groups are required to reach saturation, where a range of ideas has been expressed without any new information emerging (Krueger & Casey, 2000). Six structured GD were conducted with each significant ethnic group (Malays, Chinese, Indians) and participants from low and middle-income backgrounds. The number of participants recruited was 10 (5 males, 5 females) for each structured GD. However, the participants were chosen based on their willingness to participate in this structured GD. After the discussion session with 60 participants, the investigator decided that the information collected was sufficient to address the study objective.

3.3.3.3 Structured Group Discussion Guide

As demonstrated in Appendix E, a structured group discussion (GD) guide with study-related questions was developed beforehand to steer the discussion towards achieving the study objective. The questions were constructed after considering the appropriateness, cultural acceptability, and understanding of the content of colorectal cancer (CRC) awareness-raising mass-media campaign materials such as key messages, printed materials, and radio and TV scripts according to the Malaysian context. The content of the campaign material was adapted and reviewed in stage 2 in the English language, and back-to-back translation was done for the Malay language by a native speaker. During structured GD, we discussed the content of the campaign material in Malay and English. These questions and structured GD guide were tested for content validity by supervisors to obtain valuable data collection. The discussion mainly focused on the appropriateness, cultural acceptability, and understanding of campaign contents such as key messages, printed materials, and radio and TV scripts in Malay and English. In addition, it also identifies the targeted population's most commonly used media channels.

3.3.3.4 Structured Group Discussion (GD)

Data were collected through a six-structured group discussion (GD) conducted over four months, from September 2017 until December 2017. The semi-structured interview method was selected as the data collection technique, consisting of several main questions that helped to identify the areas to be explored and allowed the interviewer or interviewee to diverge from pursuing an idea or comment in more detail. Specifically, this technique is the most appropriate in exploring cultural acceptability and understanding of our targeted population on colorectal cancer (CRC) awareness-raising mass-media campaign materials such as key messages, printed materials, and radio and TV scripts in Malay and English.

All GDs were carried out in the neighbourhoods where the participants lived. Such locations provided a convenient, distraction-free environment in the communities where the participants stayed. The groups were organised in a circle to encourage participation (Krueger & Casey, 2000). As mentioned in Stage 2, a portable "Sony" voice recorder was used to audiotape the structured GD sessions. The voice recorder was placed in the middle of the circle to capture the best recording quality. Generally, each structured GD took a minimum of one hour to a maximum of one and a half hours.

Each structured GD begins with a self-introduction on both sides as well as the moderator and co-moderator role in the discussion to develop an interaction between participants. Then, once the researcher felt that the participants were ready, the moderator explained the study, its purpose, the duration of the GD session, audio recordings, observation of nonverbal communication cues, and note-taking of essential points during the discussion session. The co-moderator distributed informed consent forms, and separate demographic forms helped recognise participant trends.

Once all the introductions and forms were completed, the moderator proceeded to show a PowerPoint presentation consisting of key messages, printed materials, and radio and TV scripts. As the presentation progressed, participants were asked to share their opinions based on semi-structured questions provided in the guideline. Participants were also given the freedom to provide feedback on the design of the campaign materials and suggest the most effective media channels to reach the targeted population. After the structured group discussion, participants were encouraged to suggest ways to improve the campaign materials to ensure that they reach the maximum number of people in Malaysia. At the end of each discussion, the moderator recapped the main points and allowed participants to confirm or clarify their ideas. This approach helped to ensure that the moderator had accurately captured the participants' thoughts (Lewis et al., 2007). A few

minutes were allocated immediately after the discussion session to note a few points related to the discussion.

3.3.3.5 Transcription

All audio files were then transcribed completely verbatim and then destroyed. Those recorded audios were transcribed by two professional transcribers qualified in multiple languages and translated into English by a professional translator. To ensure accuracy, the investigators proofread the transcriptions.

3.3.4 Stage 4: Refinement of the content of campaign material and design

In January 2018, the refinement stage was carried out for the cultural adaptation of the mass-media campaign to raise awareness about colorectal cancer in Malaysia. During this stage, the campaign material's content and design were carefully review and refined based on the information gathered from the first three stages. Professional linguistics experts were then consulted to ensure linguistic accuracy. They translated the key messages, printed materials, and radio and TV scripts from the campaign materials to ensure that they retained the same meaning in different languages. This process was implemented to minimise instrument bias and improve the reliability and validity of the content. The experts verified the appropriateness and possible misinterpretation of the wording from the translated materials to ensure that no changes were made to the original terminology.

Furthermore, printed campaign materials (posters, bunting, billboards, brochures) and radio and television scripts were created in collaboration with local designers, guided by the key messages identified and finalised during the previous stages. Also, the selection of media communication channels for TV and radio advertisements was decided based on the results obtained from the BCA campaign and recommendations from the structured

group discussions. The selected media communications are TV3, TV8, and TV9 for TV channels, including Lite FM and Raaga FM for Radio stations.

3.3.5 Stage 5: Final trial of the content of campaign material and design

The final trial stage was carried out on February 2018. This stage aimed to finalise all content of the colorectal cancer awareness-raising mass-media campaign materials, such as key messages, printed materials, and radio and TV scripts obtained from the first three stages of cultural adaptation. At this stage, the final versions of the various material content were vetted and approved through the expert panel discussion (EPD) method for appropriateness and cultural suitability. All the processes of this method were repeated as in Stage 2 with stakeholders and experts from different fields who were different from the EPD expert panel at Stage 2. They consist of medical practitioners (n = 4), language and linguistic experts (n = 1), cancer survivors (n = 6), and the NCSM health education team (n = 7). The NCSM health education team includes public health, nutrition, biological sciences, and scientific communication expertise in the EPD for stage 5. The experts and stakeholders involved were fluent in their native speakers of the four major languages, including Malay, English, Cantonese, and Tamil, and they are also multilingual. Stakeholders reviewed the content of the campaign materials in the native language of their choice. The designers finalised all campaign designs of materials following the stakeholders' fine-tuning of the campaign's material's content. The effectiveness and acceptability of the campaign were evaluated using a population-based survey consisting of pre-campaign household surveys and post-campaign household surveys. The processes of population-based surveys are explained in detail in the subsequent sections.

3.4 Phase 3: Implementation of Intervention

A longitudinal study is a study design that describes data collection from the same individuals over an extended period (Caruana et al., 2015). This study design allows researchers to follow up with participants multiple times, collecting data on various factors such as behaviours, characteristics, attitudes, health outcomes, or other variables (Thomas, 2020). The advantage of longitudinal research in this study is that it provides more robust evidence of causal linkages than cross-sectional studies, which collect data at a particular moment. The longitudinal study method is the primary approach in this research, which is applied to address study objective four.

This study design observed the changes and improvement in knowledge, attitude, and belief towards CRC and CRC screening among the same participants over a time period throughout the study. In addition, investigators observed the changes in this study and typically compared the pre- and post-intervention data within the same group to examine the effects of the intervention. Observing the same participants over time enables researchers to investigate within-subject changes, individual development, behavioural patterns, and the effectiveness of interventions or treatments. This provides an extensive understanding of how variables change over time and the factors contributing to these changes.

3.4.1 Pre-campaign Household Survey

3.4.1.1 Study Population

The study participants consisted of adults aged 40 years and above who lived in Rawang, Selangor. According to the 2011 National Cancer (NCR) report, adults in Malaysia are more likely to be diagnosed with colorectal cancer at the age of 40 or older (Zainal Ariffin & Nor Saleha, 2011). The report revealed that the incidence of CRC increases with age, peaking between 60 and 64 years old for men and 55 and 59 years old

for women. In addition, Malaysians in this age range are more likely to be diagnosed with colorectal cancer (CRC) due to poor knowledge about CRC and CRC screening compared to younger adults. Insufficient knowledge about CRC and CRC screening among older people has been discovered in various national and international studies, including Malaysia (Koo et al., 2012). In line with this, another example of a study was conducted in Malaysia (Loh, 2013). The selected sample was designed to generalise to all the Selangor or suburban settings in Malaysia.

3.4.1.2 Inclusion and Exclusion Criteria

(a) ***Inclusion Criteria***

The inclusion criteria for the target population were

i) Men and women aged 40 years and older
ii) Living in the randomly selected households from the study areas around the Rawang, Gombak district
iii) Able to speak English or Malay and
iv) Able to complete questionnaires independently without support from other adults.
v) Willing to participate in this study

(b) ***Exclusion Criteria***

i) Diagnosed with any cancer in the past or present
ii) Professionals who worked in health care, such as doctors, nurses, clinic attendants, and pharmacists
iii) No informed consent
iv) Presented with any cognitive impairment

3.4.1.3 Study Setting

This study was carried out in Selangor, Malaysia. Selangor is known as the most populated state, with an estimated population of 6.53 million in 2019 (Department of Statistics Malaysia, 2020). Selangor is known as one of the most developed states with the largest economy in Malaysia. This state consists of three major ethnicities, with 53.56% of Malay, 25.52% of Chinese, 12.12% of Indian, and 8.80% of others. Selangor consists of 9 districts, of which Gombak is listed as one of them. Under the district of Gombak, Rawang is a subdivision that contains a mix of urban, suburban, and rural communities. It's divided into two subdivisions named Rawang 1 and Rawang 2. The study setting for this study was mainly located in the area of Rawang, with an area of 266 km2 and a total population of 199,095 (Selangor, 2024).

In Selangor, few cancer campaigns were conducted, but those campaigns did not particularly emphasise symptoms (Loh, 2017b). Rawang was selected as a study area because the population has a mix of ethnicities, age groups, education levels, and income groups. Twenty-six percent of Rawang's population is over 40 years old. Based on the Department of Statistics Malaysia (DOSM) census in 2017, Rawang well represented the general population of Selangor state, especially since the ethnicity proportions of Rawang matched the Selangor population (Malaysia, 2018). Therefore, it was found to be an ideal location for the campaign evaluation.

3.4.1.4 Sample Size Calculation

The sample size calculation was based on the percentage of exposed (BCAC-CRC recognisers) and unexposed (BCAC-CRC non-recognisers) with the outcome as improved knowledge in recognising CRC symptoms (change in bowel habits for several weeks) as reported by Schliemann et al., 2020. Using Open Epi version 3.01 software to

compare two related proportions, below are the various parameters used for the sample size calculation:

i. The direction of hypothesis = two-sided
ii. Significance level (alpha) = 0.05
iii. Probability of detection (power) = 80%
iv. The ratio of unexposed to exposed in the sample = 1.0
v. Percent of exposed with the outcome: 6.6%
vi. Percent of unexposed with the outcome: 12.7%

The sample size needed for this study was 736 participants. With an additional 30% estimated dropout, the total sample size required was 956 participants for the baseline (pre-campaign).

3.4.1.5 Sampling Method

In order to generalise the sample to the population in Rawang, a simple random sampling method was applied in this study. The rationale for choosing the random sampling technique was that there was an equal chance (probability) that each participant could be selected according to the inclusion criteria. This method will reduce the potential for human bias in selecting cases to be included in the sample.

Approximately 4000 or more household addresses from Rawang were requested from the Department of Statistics Malaysia (DOSM) for the pre-campaign survey to reach the estimated sample size. The number of households was oversampled to account for refusal, non-respondents, and participants not eligible for screening. In total, exactly 4368 household addresses were drawn from 273 Enumeration Blocks (EBs) by DOSM. EB is an artificially created contiguous geographical area with specific boundaries containing 100 households. From each EB, 16 households were randomly selected for household survey participation.

3.4.1.6 Study Variable

In this study, there were two types of variables: independent and dependent variables. The variables of the pre-campaign and post-campaign questionnaires of this study were identified based on questionnaires from several studies (Alice et al., 2012; R Ismail et al., 2019; Su et al., 2013a).

(a) ***Independent Variables***

The independent variables were categorised into four domains:

1) sociodemographic characteristics
2) family and friends with a history of CRC
3) history of CRC screening
4) BCAC-CRC materials recognition

All the independent variables and their descriptions and measurement categories are listed in Table 3.1.

Table 3.1: Operational definition and measurement categories of Independent Variables

No	Variable	Operational Defination	Measurement Categories
Sociodemographic Characteristic			
1	Age	Age reported by participants	It is categorised as 40-49, 50-59, 60 years, and above
2	Nationality	Nationality reported by participants	It is categorised as Malaysian and Non-Malaysia
3	Ethnicity	Ethnicity reported by participants	It is categorised as Malay, Chinese, Indian, and others
4	Marital status	Marital status reported by participants	It is categorised as Married and Single (including single, divorcee, and widow)
5	Education	Highest educational level reported by the participants	It is categorised as no formal, primary, secondary, or tertiary education. The classification was done based on the Department of Statistics, Malaysia's criteria

Table 3.1: Continued

No	Variable	Operational Definition	Measurement Categories
Sociodemographic Characteristic			
6	Income	Monthly household income reported by the participants	It is categorised as Below RM 4,000, RM 4,001-10, and RM 10,001 and above. The classification was done based on the Department of Statistics, Malaysia criteria.
Family and Friends with a History of CRC			
1	Family and friends with a history of CRC	Anyone family or close relation of the participants diagnosed with CRC	It is categorised as Yes (including immediate family members and close friends) and No
History of CRC screening			
1	History of CRC screening	Past five years of CRC screening uptake by the participants	It is categorised as Yes and No
BCAC-CRC campaign recognition			
1	BCAC-CRC campaign recognition	Recognition of the campaign material, such as TV, Radio advertisements, and Printed materials by the participants	It is categorised as Yes and No for i) TV Advertisement ii) Radio Advertisement iii) Printed Materials

(b) ***Dependent Variable***

The dependent variables were categorised as stated in the study objective 1.12.2: 1) BCAC-CRC mass-media campaign recognition and 2) the effectiveness of the BCAC-CRC campaign i) knowledge on symptoms and risk factors of CRC ii) attitude on help-seeking behaviour iii) belief about CRC and CRC screening. All the dependent variables and their operational definition and measurement categories are listed in Table 3.2.

Table 3.2: Operational and measurement categories of Dependent Variables

No	Variables	Operational Definition	Measurement Categories
BCAC-CRC mass-media campaign recognition			
1	BCAC-CRC campaign recognition	Participant recognition of TV, radio advertisements, or printed materials.	It is categorised as campaign recognisers and non-recognisers.
Evaluation of the effectiveness of BCAC-CRC mass-media campaign			
1	Changes in knowledge of colorectal cancer symptoms and risk factors	Improvement in knowledge of CRC symptoms and risk factors is calculated as an increase in total score after the campaign	It is reported as the total score of symptom risk factors at pre- and post-campaign. A score of one is given for every correct answer.
2	Changes in participants beliefs on cancer and colorectal cancer screening	The changes in participants' negative beliefs in cancer and colorectal cancer screening were assessed Positive beliefs were recoded as negative beliefs. Reduction in negative beliefs is calculated as a reduction in total score after the campaign	A score of one is given to those who agreed to the negative statements. It is reported as the total score of negative beliefs in pre- and post-campaign.
3	Changes in participant's anticipated time to help-seeking behaviour for specific CRC symptoms	The changes in anticipated time to help-seeking behaviour for specific CRC symptoms are assessed The participants answered to see their doctor within 2 weeks if they noticed each specific CRC symptom after the campaign was considered to have a change in their help-seeking behaviour. Improvement in the attitude of help-seeking behaviour is calculated as an increase in a total score of those who agreed to visit the doctor within two weeks after the campaign	A score of one is given to those who agreed to visit the doctor within two weeks of noticing a CRC symptom. A total score of those who agreed to visit the doctor within two weeks at pre- and post-campaign.

Table 3.2: continued

No	Variables	Operational Definition	Measurement Categories
Knowledge of symptoms and risk factors of CRC			
Symptoms of CRC			
1	Bleeding from your back passage	Do you think bleeding from your back passage could be a symptom of colorectal cancer?	The responses are categorised as Yes and No
2	Persistent pain in your abdomen (tummy)	Do you think persistent pain in your abdomen (tummy) could be a symptom of colorectal cancer? awareness	
3	Change in colorectal habits (diarrhoea, constipation, or both) over a period of weeks	Do you think a change in colorectal habits (diarrheoa, constipation or both) over a period of weeks could be a symptom of colorectal cancer?	
4	Feeling that your colorectal does not completely empty after using the lavatory	Do you think a feeling that your colorectal does not completely empty after using the lavatory could be a symptom of colorectal cancer?	
5	Blood in your stools	Do you think blood in your stools could be a symptom of colorectal cancer?	
6	Pain in your back passage	Do you think pain in your back passage could be a symptom of colorectal cancer?	
7	Lump in your abdomen (tummy)	Do you think a lump in your abdomen (tummy) could be a symptom of colorectal cancer?	
8	Tiredness/Anaemia	Do you think that tiredness/anaemia could be a symptom of colorectal cancer?	
9	Unexplained weight loss	Do you think unexplained weight loss could be a symptom of colorectal cancer?	

Table 3.2: continued

No	Variables	Operational Definition	Measurement Categories
Risk factors of CRC			
1	Drinking alcohol	Drinking more than 1 unit of alcohol a day	Five-point Likert scale is used to categorise the responses. The responses are categorised as follow: strongly disagree, disagree, not sure, agree and strongly agree
2	Eating less portions of fruit and vegetables	Eating less than 5 portions of fruit and vegetables a day	
3	Eating red or processed meat	Eating red or processed meat once a day or more	
4	Diet low in fibre	Having a diet low in fibre	
5	Overweight or obese (BMI over 25)	Being overweight or obese (BMI over 25)	
6	Being over 70 years old	Being over 70 years old	
7	Close relative with colorectal cancer	Having a close relative with colorectal cancer	
8	Doing less than 30 mins of moderate physical activity 5 times a week	Doing less than 30 mins of moderate physical activity 5 times a week	
9	Having a colorectal disease	Having a colorectal disease (e.g., ulcerative colitis, Crohn's disease)	
10	Having diabetes	Having diabetes	
Beliefs about CRC and CRC screening			
Beliefs about CRC			
1	These days, many people with cancer can expect to continue with normal activities and responsibilities.	For each of the statements, can you tell me how much you agree or disagree with each item?	The responses are categorised as follows: Strongly agree, tend to agree, strongly disagree, and tend to disagree.
2	Cancer can often be cured		
3	Going to the doctor as quickly as possible after noticing a symptom of cancer could increase the chances of surviving.		
4	Most cancer treatment is worse than the cancer itself		
5	I would NOT want to know if I have cancer.		
6	Some people think that a diagnosis of cancer is a death sentence. To what extent do you agree or disagree that a diagnosis of cancer is a death sentence?		

Table 3.2: continued

No	Variables	Operational Definition	Measurement Categories
Beliefs about CRC screening			
1	I would be so worried about what might be found at colorectal cancer screening that I would prefer not to do it.	For each of the statements can you tell me how much you agree or disagree with each item?	The responses are categorised as follow: Strongly agree, tend to agree, strongly disagree, and tend to disagree
2	Colorectal cancer screening is only necessary if I have symptoms		
3	Colorectal cancer screening could reduce my chance of dying from colorectal cancer		
Attitude on help-seeking behaviour			
1	Rectal bleeding	Please tell me how long it would take you to go to the doctors from the time you first noticed the symptom	It is categorised as "less than 2 weeks" and "more than 2 weeks".
2	Abdominal bloating		
3	Blood in your stool		
4	Looser stool than usual for 6 weeks or more		
5	Persistent pain in your abdomen		
6	Unexplained weight loss		

3.4.1.7 Study Instrument

An identical questionnaire was utilised for both the pre-and post-household surveys, and it was categorised as a close-ended questionnaire. However, additional BCAC-CRC mass-media campaign recognition variables were added to the post-questionnaire in order to measure the campaign's reach, perception, and perception among participants. There are six main sections included such as 1) sociodemographic characteristics, 2) family and friends with a history of CRC, 3) history of CRC screening, 4) BCAC-CRC related questions, i) campaign materials recognition and ii) opinion on the campaign materials 5) BCAC-CRC, and 6) the effectiveness of the BCAC-CRC campaign i) knowledge on symptoms and risk factors of CRC ii) attitude on help-seeking behaviour iii) belief about CRC and CRC screening as attached in Appendix F and Appendix G.

(a) *Sociodemographic Characteristic*

The sociodemographic characteristics questionnaire was designed to collect information on demographic and socioeconomic characteristics. The sociodemographic sections included age, gender, ethnicity, marital status, education levels, and monthly household income. There was a total of 6 questions to complete from this section.

(b) *Knowledge about CRC*

The knowledge about CRC was measured using the Bowel Cancer Awareness Measure (CAM) toolkit version 2.1. The CAM questionnaire was collaboratively developed by Cancer Research UK, University College London, Kings College London, and Oxford University between 2007 and 2008 (Stubbings et al., 2009). Su et al. from the Centre for Population Health (CePH), Department of Social and Preventive Medicine, Faculty of Medicine, University Malaya, adapted, modified, validated, and translated the questionnaire to align with the Malaysian context. The present study used a questionnaire that had been validated and translated by Su et al. (Su et al., 2013a). The CAM questionnaire consisted of twenty-two CRC-related questions. There are ten on knowledge about symptoms (one unprompted and nine prompted), eleven on risk factors (one unprompted and ten prompted), and finally, one on CRC history.

i Knowledge of CRC symptoms and risk factors

The section started with one open-ended question to measure how many CRC symptoms a participant can recall without prompting, followed by nine closed-ended questions. The stems of the section were constructed as instructions to measure the knowledge about CRC symptoms. For the closed-ended questions, one score is given for the correct answer. The closed-ended questions measured nine CRC symptoms, such as bleeding from the back passage, persistent pain in the abdomen, change in colorectal

habit, feeling of incomplete emptiness of colorectal, blood in stool, pain in the back passage, lump in the abdomen, tiredness/anaemia, and unexplained weight loss.

The section on knowledge of risk factors started with one open-ended question to measure how many CRC risk factors a participant can recall without prompting, followed by ten close-ended questions. The stems of the section were constructed as instructions to measure the knowledge about CRC risk factors. The closed-ended questions measured ten CRC risk factors, such as drinking more than 1 unit of alcohol a day *(clarification for this question was given by using a show card to illustrate)* (Appendix H), eating less than five portions of fruit and vegetables a day *(clarification for this question was given by using show card to illustrate)* (Appendix I), eating red or processed meat once a day or more, having a diet low in fibre, being overweight or obese, being over 70 years old, having a close relative with bowel cancer, doing less than 30 minutes of moderate physical activity five times a week, having a bowel disease, having diabetes. For this section, all items were scored using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), as a higher ranking on the Likert scale indicates greater agreement with the risk factors that were assessed. The scores were summed together, and the total score for prompted knowledge of symptoms and risk factors of CRC was produced (score range 0 – 19).

(c) *Attitudes and Beliefs about Colorectal Cancer and Screening*

This study used the Awareness and Beliefs about Cancer questionnaire (ABC), which was originally published by Alice et al. (2012) (Alice et al., 2012). However, local researchers adapted, modified, validated, and translated the questionnaire to align with the Malaysian context, but the questionnaire was not published. The first section of this questionnaire consists of statements about cancer beliefs. For the belief section, the original author measured belief in cancer instead of a specific cancer. This is because

assessing personal views and beliefs on cancer is also a proxy for understanding the beliefs about other cancers (Alice et al., 2012). The second section of the questionnaire is about the history of CRC screening, followed by the third section on beliefs about CRC screening (Faecal Occult Blood Test (FOBT) and colonoscopy), and the final section is an attitude towards help-seeking behaviour.

i Beliefs in Cancer

This section started with six questions on general cancer beliefs, beliefs about the early symptomatic presentation, and the early cancer diagnosis. For this section, all items were scored using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), as a higher ranking on the Likert scale indicates greater agreement with the beliefs that were assessed.

ii History of Cancer Screening

There is one question on the history of CRC screening. The question is, "Have you had a CRC screening test in the past five years?". The response categories for these questions were "Yes," coded as 1, and "No," coded as 0.

iii Beliefs about Cancer Screening

This section contains three statements regarding beliefs about CRC screening (Faecal Occult Blood Test (FOBT) and colonoscopy). For this section, all items were scored using a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), as a higher ranking on the Likert scale indicates greater agreement with the risk factors that were assessed.

iv Attitude toward Help-Seeking Behavior

The section consists of six closed-ended questions regarding attitude towards help-seeking behaviour. The items that were evaluated in this section are an anticipated time for seeking medical assistance if they noticed CRC symptoms. The stem of the section was constructed as an instruction to measure the attitude towards help-seeking behaviour. The stem statement about the anticipated delay in help-seeking was phrased as "Please tell me how long it would take you to go to the doctor from the time you first noticed the symptoms". This statement is followed by the listed symptoms, such as rectal bleeding, bleeding from the back passage, abdominal bloating, blood in your stool, looser stool than usual for 6 weeks or more, persistent pain in your abdomen, and unexplained weight loss. The response categories are listed as 1 = up to 1 week, 2 = over 1 to 2 weeks, 3 = over 2 to 3 weeks, 4 = over 3 to 4 weeks, 5 = more than a month, 6 = I would go as soon as I noticed, 7 = I would not contact any doctor, 8 = I would go to a traditional healer, 9 = I would go to a pharmacy, 10 = I would self-medicate, 11 = I would go to any other healthcare professional (nurse, medical assistant) instead of a doctor.

3.4.1.8 Enumerator Training

The training was conducted for three days at the Department of Social and Preventive Medicine, Faculty of Medicine. On day one, enumerator training for household surveys was conducted to explain survey protocols, design, and questionnaires as well as their roles and duties. The enumerators were required to do a mock data collection on day two at the field, followed by giving feedback on day three.

On day one, enumerator training comprised: 1) Research background, objective, and study area; 2) The role of an enumerator; 3) The protocol of household data collection; and 4) The content of the questionnaire.

For the training on the role of an interviewer, a group activity was conducted to make enumerators understand more about the role of an interviewer. The enumerators were grouped into five in each group for the activity. Each group was given 10 minutes to discuss and present the qualities of a good interviewer as well as the do's and don'ts of an interviewer. At the end of the presentation, enumerators were more confident and understood their job scope.

For the training on the procedure of household data collection, enumerators were given brief details about the data collection process and the proper approach to react to the different types of survey scenarios, such as households that agree, households that refuse/said 'NO,' households that are not reachable/unavailable, and households that are empty.

In the final phase, each question-and-answer from the questionnaire was described in detail. Then, the enumerators are allowed to practice among themselves to make them more understanding of the survey questionnaires. At the end of day one training, all the enumerators understood the research study well, learned about good research practices, understood the role and responsibilities of interviewers and supervisors, and became familiar with the household survey.

Day two of the training required practical training in household surveys in the field. The enumerators were allowed to practice household surveys with the Rawang community to understand more about the field survey. At the end of day two, the practice in the community makes the enumerators gain more confidence in carrying out the household survey.

Day three of the training was mainly to discuss and get feedback on day two's field practice at Rawang. During the discussion, the enumerators voiced their experiences and clarified their doubts regarding the field practice (household survey). By the end of

the day, all the enumerators were well-trained and ready to start the actual household data collection.

After the campaign ended, the same trained enumerators who conducted pre-campaign household surveys were given a thorough explanation of the BCAC-CRC. They were shown all the campaign materials such as TV and radio advertisements, social media posts, posters, brochures, billboards, banners, and bunting. Furthermore, they were also given a detailed explanation of the new questions related to the campaign that were added to the post-campaign household survey questionnaire.

3.4.1.9 Data Collection

The pre-campaign household survey was conducted for three months, from January to March 2018. The data collection began with the distribution of invitation letters through postal to all 4,368 households DOSM-selected by trained enumerators. The invitation letter described the purpose and duration of the study and the random selection of their household for the data collection.

The trained enumerators approached and invited all family members in the selected households at Rawang based on the inclusion criteria. The selected participants were informed of the study's purpose, and the participants were provided with an information sheet that elaborated in detail about the survey.

The trained enumerators conducted the face-to-face interview using a structured and validated questionnaire after consent was obtained from the participants. The questionnaires were labelled for the household code and the participants' Mykad number to facilitate the data entry. The questionnaire measured knowledge, attitudes, and beliefs about CRC and screening during the pre-campaign household survey. Enumerators took approximately fifteen to twenty minutes to complete a survey. The unreachable and empty

households were replaced during the data collection by choosing the households from the right-hand side.

3.4.2 Implementation of Be Cancer Alert Campaign – Colorectal Cancer

3.4.2.1 Types of Mass Media Campaign

The study's intervention is called the "Be Cancer Alert Campaign" for Colorectal Cancer (BCAC-CRC). The campaign's TV advertisement was broadcasted on three main national channels: TV3, TV9, and 8TV. The BCAC-CRC Radio advertisement was aired on Astro radio stations, such as Lite FM and THR Raaga, throughout Malaysia during the campaign. The mass-media's primary focus was on TV commercials, as earlier national and international campaigns had shown it to be the most effective intervention mode (Radford, 2011; Saleh et al., 2012). The BCAC-CRC was also promoted on social media and a website. Facebook and Twitter were used to create and disseminate the social media materials. The comprehensive details about implementation of the mass-media campaign were provided in Chapter 4.

(a) ***Television (TV) Advertisement***

The main messages of Television (TV) advertisements focused on CRC awareness and the importance of early detection of CRC. A local Chinese male CRC survivor conveyed these key messages. The two Malay (TV3 and TV9) and one Chinese (8TV) national channel were chosen to broadcast the BCAC-CRC advertisement based on the group discussion feedback and to reach the two largest ethnic groups in Malaysia. For Indian ethnicity, their second preference for TV channels is Malay channel (TV3) besides Tamil channels. The TV advertisements were created in various languages, such as Malay, Mandarin, and English, in order to reach specific ethnicities through the above TV

channels. This advertisement was also uploaded to the National Cancer Society Malaysia's YouTube channel.

(b) ***Radio Advertisement***

The radio advertisement's key messages focused on the symptoms and the importance of early detection of CRC. One male and one female radio presenter presented the radio advertisement to raise awareness about CRC, which affects both genders in Malaysia. Besides conveying the key messages, the male and female radio presenters also emphasise that CRC can be diagnosed in both genders. Based on the feedback from an expert panel discussion, the duration of the radio advertisement was shortened from 40 seconds (Be Cancer Aware campaign) to 30 seconds. As mentioned earlier, the TV advertisement mainly targeted the Malay and Chinese populations. Therefore, radio advertisements were created in English and Tamil to reach Indian ethnicity specifically. The BCAC-CRC radio advertisements were broadcast through Astro Lite FM in English to reach all Malaysians and Thr Raaga in Tamil to reach Indian ethnicity who didn't watch the chosen TV channels for intervention.

(c) ***Social Media and Webpage***

The BCAC-CRC social media campaign posts were mainly focused on the CRC symptoms and call to action: i) infographic on symptoms of CRC, ii) visit the campaign website for further information, and iii) call the National Cancer Society toll-free helpline to obtain information related to CRC. The CRC-related posts were developed and shared through the National Cancer Society Malaysia (NCSM) Facebook page. The group discussion identified and chose Facebook because it is known as the most commonly used social media platform. A website for BCAC-CRC was created to make campaign materials available and to highlight knowledge about CRC. In addition, NCSM's toll-free

helpline number was included on Facebook and the website, which offered professional advice regarding cancer-related topics. The implementation of the various mass-media campaigns is shown in Table 3.3.

Table 3.3: Implementation of the Be Cancer Alert CRC Campaign in various Maas-media campaigns

Be Cancer Alert CRC Campaign (Malaysia)	
TV Advertisements	• TV3, TV9, and 8TV • Time period: 2nd April – 6th April 2018 • Available on YouTube • Duration: 30s for 5 weeks (4–6 advertisements per day) • Language: Malay (TV3 & TV 9), Mandarin (8TV) and English (YouTube)
Radio Advertisements	• Lite FM and THR Raaga • Time period: 9th April – 22nd April 2018 • Duration: 30s; 2 weeks (5–7 advertisements per day) • Language: English (Lite FM) and Tamil (THR Raaga)
Social Media	• Facebook: National Cancer Society Malaysia (https://www.facebook.com/nationalcancersocietymalaysia) • Language: English
Website	• Website URL: http://www.becanceralert.com/ • Language: English and Malay

3.4.2.2 Printed Campaign Material

The printed BCAC-CRC campaign materials were available in various types, such as posters, brochures, bunting, and billboards. The implementation of a mass-media campaign for the printed material was only available in Rawang, Selangor. The colon image was shown on posters, buntings, and billboards because many people were unaware of the anatomy of the colon. The key message "Don't be shy to check your stool" was used to encourage people not to hesitate to consult any healthcare providers. The content of buntings, banners, and billboards was presented in Malay and was approved by "Dewan Bahasa dan Pustaka" (DBP). DBP is a government agency responsible for coordinating the use of the Malay language and Malay literature in Malaysia. Approval was obtained from the Selayang Municipal Council in order to display printed outdoor

advertisements such as buntings, banners, and billboards. Buntings, banners, and billboards were also displayed in Rawang town and nine villages. In addition, banner and roll-up banners were displayed at Tesco's hypermarket, Rawang.

All private clinics in Rawang were approached, and their permission was obtained to display BCAC-CRC posters and distribute brochures. Eleven private clinics agreed to display the BCAC-CRC posters and distribute the brochures. Approval was also obtained from the district health office to display BCAC-CRC posters and banners and distribute brochures in the seven government clinics in Rawang. Brochures in various languages are attached in Appendix J (English), K (Malay), L (Tamil), and M (Chinese). In addition, the poster, buntings, banners, and billboards are attached in Appendix N (English) and O (Malay). The implementation of a mass-media campaign for the printed materials is shown in Table 3.4.

Table 3.4: Brief details about the Be Cancer Alert Campaign – Local media campaign

Be Cancer Alert CRC Campaign (Malaysia)	
Printed Materials	• Billboards (around Rawang) • Street buntings (around Rawang) • Posters and brochures in 7 public and 11 private clinics • Outdoor banners and roll-up banners in a supermarket (Tesco, Rawang) • Outdoor banner at 9 Villages at Rawang • Language: English and Malay
Campaign Duration	5 weeks (2nd April – 6th May 2018)

3.4.2.3 Be Cancer Alert Campaign Soft Launch

The BCAC-CRC soft launch was conducted on 5th April 2018 at the Universiti Malaya. During the campaign soft launch, CRC survivors shared their stories and experiences during the treatment and recovery phase. Social Media Influencers Jack Lim and Fara Fauzana were invited to attend the soft launch and promote the BCAC-CRC on

their personal Instagram. During the soft launch, the media were invited to a press conference, and the news about the BCAC-CRC appeared on the TV3 channel.

3.4.3 Post-campaign Household Survey

The post-campaign household survey data collection was conducted for three months (May to June 2018) and started after completing the mass-media campaign. The same respondents who participated in the pre-campaign household survey were interviewed during the post-campaign household survey. The outcome measure for the post-campaign household survey was the reach and effectiveness of the intervention on the awareness-raising (knowledge, attitude, and beliefs) about colorectal cancer and screening (belief and experience). Trained enumerators conducted this survey using a data collection protocol similar to the pre-campaign household survey. The questionnaires were labelled according to household code and participant's identity card number, similar to the pre-intervention phase. The data was monitored at the study site to ensure the quality and no missing data.

3.4.3.1 Study Instrument

The same questionnaire was used for both pre and post-campaign household surveys. Twenty-one new questions regarding the BCAC-CRC were added to achieve two aims (Appendix G), which were

i. To assess whether the BCAC-CRC materials (intervention) such as posters, brochures, bunting, banners, Television (TV) advertisements, and radio advertisements in the past month reached study participants
ii. To determine whether the campaign materials are relevant, thought-provoking, and culturally acceptable to local participants

(a) ***BCAC-CRC Reach among Rawang Population (Post-campaign survey)***

The twelve new questions assessed whether the target population was able to i) recall key messages and ii) recognise materials (Appendix G). The first three open-ended questions were used to identify which Television (TV) channels, radio stations, and newspapers were viewed, listened to, or read, most often by interviewees (up to three options per type of media). Participants were shown the BCAC logo and asked whether they had previously noticed it. The 13 following questions were specifically about BCAC-CRC's materials, logo, and key messages. The questions related to the campaign started with any cancer campaign materials and key messages the participants had noticed or encountered in the past month. Participants were shown the TV, radio, and printed campaign materials and then asked whether they previously saw each specific campaign material.

(b) ***Feedback on BCAC-CRC Material among the Rawang Population (Post-campaign survey)***

Participants were asked nine new questions about their view about the BCAC-CRC materials, including whether they were relevant, thought-provoking, and culturally acceptable.

3.5 Data Management

The collected data underwent the processes of data entry, data cleaning, missing value, data coding, and data security. The detailed process is described in the subsequent sections.

3.5.1 Data Entry

The questionnaires were thoroughly checked twice before entering the data into SPSS version 20. The enumerators did the first check after the house visit, and the researchers conducted the second check. Two independent persons who were not acquainted with each other entered all the collected pre-campaign and post-campaign data into the template created by the researcher. The researcher provided training to both persons on how to key in the data. After that, the researcher merged the pre- and post-campaign data, which was then rechecked to eliminate any errors. The researcher did a 100% visual cross-check between the raw data on the questionnaires and the entered data to ensure accuracy.

After the data had been entered, they were double-checked for errors, variable accuracy, consistency, and coding. The researcher verified the data entry quality by re-entering 10% of randomly chosen participant questionnaires. In the Excel file, the initially entered data and re-entered data were compared and checked for every variable for each participant. The discrepancies in the data were cross-checked and verified by comparing them with the original survey questionnaires. In addition, before proceeding to the data analysis phase, each data variable was cross-checked with the initial survey questionnaires to ensure that they were accurate and of good quality. The merging data were then treated for missing data, cleaned, and analysed.

3.5.2 Data Cleaning

First, the researcher reviewed the type of variable and the measurement scale for all the listed variables. The researcher ensured that the variable type was set to ‘numerical’ for the quantitative and qualitative variables. As for the measurement scale, the researcher changed the scale according to the type of data. For quantitative variables that were either discrete or continuous data, it was set to ‘scale.’ On the other hand, qualitative variables were set to ‘nominal’ or ‘ordinal’ depending on the characteristics of the data.

As mentioned above, outliers, double entries, and missing values were identified for the current study. The identified double entries were deleted. The researcher checked the missing values during the verification step by calling those participants who had provided a contact number.

Besides identifying missing values, the data was checked for any outliers in the quantitative data or abnormal data points in the qualitative data. The outliner was identified by a frequency test. These two issues occur when data is wrongly entered or participants give an incorrect answer. In such instances, a correction was made by checking the questionnaire booklet, seeking clarification from the participants via telephone, or deleting the case. It is essential to deal with abnormal data points and outliers, as their presence may lead to an inappropriate interpretation of the result.

3.5.3 Data Categorising and Coding

The variables below were recoded to new variables to meet the inferential analysis's assumption. Data coding and data transformation were performed to get significant variables. For example, a variable that has more than two categories can be transformed into two groups if the number of observations in one of the groups is too low and will consequently violate the assumption of the statistical analysis.

Table 3.5: Recoding of variable

Variables	New Variable
Age	Continuous to Categorical 1= 40 – 49, 2 = 50 – 59 and 3= 60 above
Gender	1= Male and 2 = Female
Ethnicity	1= Malay, 2 = Chinese, 3 = Indian and 4 = Other
Marital Status	1= Single, 2 = Married, 3 = Divorced, and 4 = Widow Recoded 1= Single and 2 = Married Regrouped 1 = a combination of single, divorced, and widow, 2 = married
Education	1= Never schooled, 2 = Never completed primary school 3 = Completed primary school, 4 = Completed from 3, 5 = Completed form 5, 6 =Certificate, 7 = A Level/STPM/HSC, 8 = Diploma, 9 = Bachelor degree, 10 = Post-graduate degree and 11= Others Recoded 1= No formal education, 2 = Primary education, 3 = Secondary education, and 4 = Tertiary education Regrouped 1 = combination of never schooled and never completed primary school, 2 = completed primary school, 3 = combination of the completed form 3, completed form 5, certificate, and A-level/ STPM/ HSC, and 4 = combination of diploma, bachelor degree, and post-graduate degree.
Monthly income	1= RM 2,000, 2 = RM 2,000 – RM 3,000, 3 = RM 3,000 – RM 4,000, 4 = RM 4,000 - RM 5,000, 5 = RM 5,000 - RM 10,000, 6 = RM 10,000 and above Recoded 1= Below RM 4,000, 2 = RM 4,000 - RM 10,000, and 3 = RM 10,000 above Regrouped 1= combination of below RM 2,000, RM 2,000 – RM 3,000, and RM 3,000 – RM 4,000 2 = combination of RM 4,000 - RM 5,000 and RM 5,000 - RM 10,000 3 = RM 10,000 and above
Family and friends with a history of CRC	1= No, 2 = Yes, I did, and 3 = Yes, a family member/friend did Recoded 1= No and 2 = Yes Regrouped 0 = No 1 = combination of yes, I did, and yes, a family member/friend did

Table 3.5: Continued

Variables	New Variable
History of CRC Screening	1= No, 2 = Yes, 98 = No reply, and 99 = Don't know Recoded 0 = No and 1= Yes Regrouped 1= No and 2 = Yes The no reply and don't know are classified as a missing value
Knowledge of CRC Symptoms	1= No, 2 = Yes, 98 = No reply and 99 = Don't know Recoded 0 = No and 1= Yes Regrouped 0 = combination of no, no reply, and don't know 1 = Yes
Knowledge of CRC Risk Factors	1= No, 2 = Yes, 98 = No reply and 99 = Don't know Recoded 0 = No and 1= Yes Regrouped 0 = combination of no, no reply, and don't know 1 = Yes
Improvement in the total score of knowledge of CRC (symptom + risk factor score)	Recoded 0 = No and 1= Yes Regrouped 0 = Sum of the numbers (total score) in the post-campaign household survey is lesser than the sum of the numbers (total score) in the pre-campaign household survey and 1= Sum of the numbers (total score) in the post-campaign household survey is greater than the sum of the numbers (total score) in the pre-campaign household survey
Belief on cancer	1= Strongly disagree, 2 = Tend to disagree, 3=Not sure, 4 = Tend to agree, 5 =Strongly agree, 98 = No reply and 99 = Don't know Recoded 0 = Disagree and 1= Agree Regrouped 0 = Combination of tend to disagree and strongly disagree and 1= Combination of tend to agree and strongly agree The not sure, and no reply were categorized as missing values
Belief in CRC screening	1= Strongly disagree, 2 = Tend to disagree, 3 = Not sure, 4 = Tend to agree, 5 = Strongly agree, 98 = No reply and 99 = Don't know Recoded 0 = Disagree and 1= Agree Regrouped 0 = Combination of tend to disagree and strongly disagree and 1= Combination of tend to agree and strongly agree The not sure, and no reply were categorized as missing values

Table 3.5: Continued

Variables	New Variable
Negative belief in cancer and CRC screening	Recoded 0 = No positive change in belief and 1= Positive change in belief Regrouped 1= Positive change in belief Negative belief - participants who agreed to negative cancer and CRC screening belief in the pre-campaign household survey but disagreed with negative cancer and CRC screening belief in the post-campaign household survey Positive belief - participants who disagreed with positive cancer and CRC screening belief in the pre-campaign household survey but agreed to positive cancer and CRC screening belief in the post-campaign household survey 0 = No positive change in belief. Negative belief - participants who disagreed with negative cancer and CRC screening belief in the pre-campaign household survey but disagreed with negative cancer and CRC screening belief in the post-campaign household survey Positive belief - participants who disagreed with positive cancer and CRC screening belief in the pre-campaign household survey but disagreed with positive cancer and CRC screening belief in the post-campaign household survey
Total score of reduction of negative belief in belief (cancer + CRC screening)	Recoded 0 = No and 1= Yes Regrouped 0 = Sum of the numbers (total score) positive changes in the post-campaign household survey is lesser than the sum of the numbers (total score) in the pre-campaign household survey and 1= Sum of the numbers (total score) of positive changes in the post-campaign household survey is greater than the sum of the numbers (total score) in the pre-campaign household survey

Table 3.5: Continued

Variables	New Variable
Attitude - Anticipated delay in help-seeking behavior	1= Up to 1 week, 2 = Over 1 up to 2 weeks, 3 = Over 2 up to 3 weeks, 4 = Over 3 up to 4 weeks, 5 = More than a month, 6 = I would go as soon as I noticed, 7 = I would not contact any doctor, 8 = I would go to a traditional healer, 9 = I would go to a pharmacy, 10 = I would self-medicate, 11 = I would go to any other healthcare professional (nurse, medical assistant) instead of a doctor, 98 = No reply and 99 = Don't know Recoded 0 = More than 2 weeks and 1= Less than 2 weeks Regrouped 0 = Combination of other categories, except for no response and don't know, which are missing values 1= Combination of up to 1 week, over 1 up to 2 weeks, and I would go as soon as I noticed The no response, no reply and don't know were categorized as missing values
Attitude - Improvement in the total score of the anticipated delay in help-seeking behavior	Recoded 0 = No and 1= Yes Regrouped 0 = Sum of the numbers (total score) of positive changes (attitude) in the post-campaign household survey is lesser than the sum of the numbers (total score) in the pre-campaign household survey and 1= Sum of the numbers (total score) of positive changes (attitude) in the post-campaign household survey is greater than the sum of the numbers (total score) in the pre-campaign household survey
TV advertisement recognition	1= No, 2 = Yes, 98 = No reply and 99 = Don't know Recoded 0 = No and 1= Yes Regrouped 0 = Combination of no, no reply, and don't know 1= Yes
Radio advertisement recognition	1= No, 2 = Yes, 98 = No reply and 99 = Don't know Recoded 0 = No and 1= Yes Regrouped 0 = Combination of no, no reply, and don't know 1= Yes

Table 3.5: Continued

Variables	New Variable
Printed material (posters, bunting, billboards, brochures) recognition	1= No, 2 = Yes, 98 = No reply and 99 = Don't know Recoded 0 = No and 1= Yes Regrouped 0 = Combination of no, no reply, and don't know 1= Yes
Recognition of BCAC-CRC	Recoded 0 = No and 1= Yes Regrouped 1 = Sum of the numbers (total score) of any BCAC-CRC material is higher than one 0 = Didn't see any of the BCAC-CRC material

3.5.4 Data Security and Confidentiality

All the hard copies of the completed pre- and post-campaign questionnaire, the written notes, and audio transcribed from qualitative interviews and the formative evaluation was stored safely in a filing cabinet secured with a lock and accessible only to the researcher. All audio files from the qualitative study phase were transcribed verbatim and destroyed.

Quantitative data saved as SPSS files were archived digitally, and their copies were hosted and backed up on the research centre's computer drives of both of the consortium's member institutes. The data were password-protected, and participant identifiers were eliminated.

Personal information collected from participants included their names, ages, genders, ethnicities, addresses, telephone numbers, email addresses, and Study IDs. These data were stored in a Master File with password protection on the main computer at the CePH research centre, which the researcher was the only person who could access. The confidentiality of all data was strictly maintained.

All primary data sources will be maintained for a period of ten years so that they can be reanalysed and audited as necessary in accordance with the appropriate governance practices.

3.6 Data Analysis

Independent variables were related to the characteristics of the study participants, which consist of factors influencing CRC awareness on knowledge, attitudes, and beliefs towards cancer and CRC screening.

3.6.1 Descriptive Analyses

Once the data had been cleaned and recoded or transformed into significant variables, the selected variables were tested to fulfil the assumption of the chosen statistical analysis.

A study was conducted to determine the level of awareness of colorectal cancer (CRC) among the people of Gombak district (Rawang). The study included an analysis of knowledge (symptoms and risk factors), attitudes (help-seeking behaviour), and beliefs (cancer and CRC screening) before and after the BCAC-CRC campaign. Additionally, the study evaluated the effectiveness of campaign materials such as TV and radio ads, posters, billboards, brochures, etc. The study measured the recognition of these materials and the frequency of perceptive and perceptions regarding them. It also assessed participants' opinions on the campaign materials, including whether they found them relevant, thought-provoking, or culturally acceptable. The results were presented in percentages.

3.6.2 Bivariate Analyses

The first part of the bivariate analysis used the McNemar test for dichotomous variables to assess differences in awareness regarding CRC symptoms, risk factors, attitudes, and beliefs about cancer and CRC screening before and after the campaign. The bivariate analysis involves the analysis of the association between one independent variable and the outcome variables, namely, awareness regarding knowledge of CRC (symptoms and risk factors), attitudes (help-seeking behaviour), and beliefs (cancer and

CRC screening) after the campaign. As the outcome variables were not normally distributed, the Mann-Whitney test for two independent samples and the Kruskal Wallis test for more than two independent samples were used to report the median and IQR for each independent group in the samples. The significance level was set at < 0.05.

3.6.3 Multivariate Analyses

A multivariable analysis was performed to determine the factors associated with the outcome. Generalised Estimating Equations (GEE) analysis was conducted to assess the overall changes in awareness of CRC knowledge (symptoms and risk factors), attitudes (help-seeking behaviour), and beliefs (cancer and CRC screening). The model was adjusted for other covariates, including gender, ethnicity, age (in categories), marital status, education, monthly family household income, family and friends with a history of CRC, history of CRC screening, and recognition of BCAC-CRC material.

The GEE model is executed by selecting an appropriate correlation structure. Because of the flexibility of the GEE models, there are a variety of correlations that can be specified. For example, in a repeated measures design, an autoregressive correlation could be specified, whereas for clustering at, for example, a family level, an exchangeable correlation structure is often more appropriate (Ballinger, 2004). Regardless of the specification of the correlation, GEE models are robust to the misspecification of the correlation structure (Liang & Zeger, 1986). Additionally, selecting robust standard errors (Huber/White Sandwich Estimators, as opposed to conventional standard errors) will allow the estimates to be valid even in the event of misspecification of the correlation structure (StataCorp, 2003).

A logistic regression analysis was used to identify the factors associated with participants' recognition of any of the BCAC-CRC materials. The generalised Linear Model was used to determine the factors associated with the four domains:

sociodemographic characteristics, family and friends with a history of CRC, history of CRC screening, and BCAC-CRC recognition.

3.7 Ethical Considerations

Primarily, this research was commenced by obtaining formal ethics from the Ministry of Health of Malaysia (Appendix P) and the Universiti Malaya Medical Centre (UMMC) Research and Ethics Committee (Appendix Q).

Ethical approval for this research was obtained from two ethical committees before the data collection. The ethical committees in question were:

1) The Medical Research Ethical Committee (MREC) (ID: NMRR-17-2788-35613), chaired by the Director of Medical Research at the National Medical Research Registry (NMRR) (Appendix P)
2) The University of Malaya Medical Ethics Committee (UMMEC) (ID: 2016126-4668) (Appendix Q).

Approval was explicitly sought from the MREC to collect data from eligible participants from selected households located in the study area, a requirement set by the NMRR for any research involving Malaysian populations. Approval was obtained from the UMMEC to collect data from households.

Eligible participants were required to provide written consent (Appendix R) and return it with the completed questionnaire. It was stated in the 'Participant Information Sheet' that participation in this study was on a voluntary basis and that they could opt not to participate without fear of any negative consequences (Appendix S). In addition, they were informed about the anonymity and confidentiality of their responses. Every participant was given a token of appreciation for their participation to thank them for their interest and time spent answering the questionnaire.

CHAPTER 4: RESULTS

4.1 Introduction of this Chapter

In this chapter, the findings of the study are presented in alignment with each phase and specific objective. The initial phase of the study involved identifying the number of articles related to colorectal cancer (CRC) screening. The outcome of Phase I highlighted significant variations in awareness of symptoms and barriers to CRC screening across different studies. It was evident that a multifaceted approach would be necessary to address the diverse needs of populations and the barriers to cancer screening, thereby encouraging early presentation of symptomatic cancer patients. This realisation led to the design of a mass-media campaign in the subsequent phase of this study, which involved expert panel discussions and group discussions.

In Phase II of the study, the findings from expert panels and group discussions informed the cultural adaptation and development of a CRC awareness-raising mass-media campaign using the Heuristic Framework. Phase III involved a longitudinal study with three stages: the pre-household survey, the implementation of the developed CRC awareness-raising mass-media campaign, and the post-household survey. Finally, this chapter provides a brief overview of data management and a detailed explanation of the data analysis process.

4.2 To conduct a systematic review to identify the awareness of colorectal cancer symptoms and barriers to colorectal cancer screening among Malaysians

4.2.1 Description of the article selection

The literature search using an electronic database yielded 832 articles; after excluding duplications, 528 articles were identified. Four hundred ninety-three articles were excluded based on the title screening, followed by 13 articles based on the abstract

screening. Those articles were excluded because these studies focused on CRC intervention studies or they did not access specific symptoms or screening barriers. Of the 22 remaining articles, 14 articles were included after reading the full text. The six articles were excluded because they didn't report the specific outcome variables, such as early CRC symptoms and barriers to CRC screening. In contrast, the other two article's study design did not meet an inclusion criterion of the study. Thus, 13 articles were included in this systematic review (Figure 4.1).

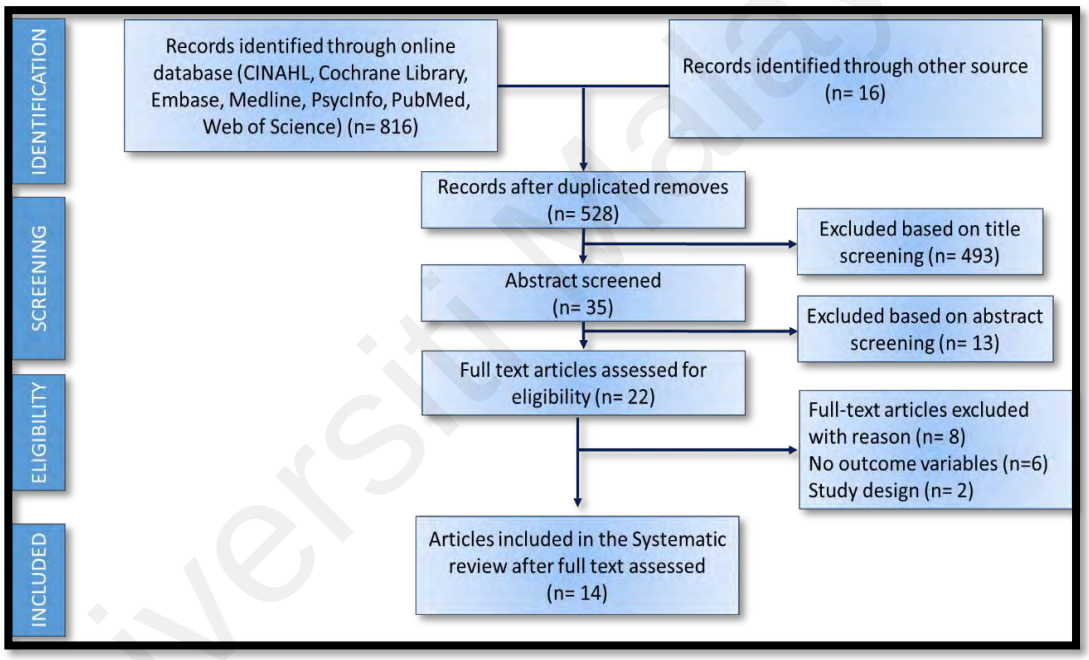

Figure 4.1: Flow diagram of the studies retrieved for the review

4.2.2 Characteristics of the Selected Colorectal Cancer Studies

Table 4.1 summarises the first author, publication year, study area, study populations, study setting, sample size, survey tools, measured outcome, outcomes, and recommendations of the 14 selected studies. All the studies were conducted in Peninsular Malaysia. Of the selected studies, thirteen are quantitative, and one is qualitative. Most of the studies (n = 7 studies) were carried out in urban areas, followed by suburban areas (n = 2 studies), urban and suburban areas (n = 1 study), rural (n = 1 study), and others

were from both urban and rural areas (n = 3 studies). Six studies evaluated CRC symptom knowledge, four evaluated CRC screening barriers, and four evaluated CRC symptom knowledge and CRC screening barriers out of fourteen CRC studies. The participants in the selected studies were the general public; there were no articles on professionals, particularly healthcare workers. Among 13 studies, nine recruited participants from hospitals or clinics, three from the household, and two from the general population. All the selected studies used different measuring tools to measure awareness of CRC symptoms and barriers to CRC screening except for four studies used the Bowel CAM questionnaire (Schliemann, Paramasivam, et al., 2020; Sindhu et al., 2019; Su et al., 2013a; Yan et al., 2017). The outcome assessed in most studies (80%) was awareness regarding CRC symptoms, which indicated an alarming lack of awareness among Malaysians regarding symptoms of CRC. All the studies conducted on barriers to CRC screening have consistently demonstrated a lack of awareness among Malaysians regarding the screening methods available. Furthermore, there is a notable reluctance among them to undergo the screening process.

Table 4.1: Evidence on the Awareness of CRC Symptoms and Barriers to CRC Screening

Authors (Year)	Study design and study area	Study population and Study setting	Sample size (n)	Survey tool	Measured Outcome[a]	Outcomes and Recommendation
Hilmi et al. (2010)	a) Prospective Study b) Kuala Lumpur (Urban)	Male and female who accompanied patients to the general medical clinic in the hospital	991	*Tool:* Self-developed tool and Health Belief Model Scale	Outcome 1) Awareness of CRC Symptoms Outcome 2) Barriers to CRC screening	Outcome 1: The awareness of CRC symptoms was reported to be low among Malaysians. Outcome 2: Most of the participants are unwilling to undergo screening, mainly Chinese, who are at greater risk for CRC. Recommendation: Extensive CRC education is needed for health care professionals as well as the public
Hashim et al. (2011)	a) Cross Sectional Study b) Universiti Kebangsaan Malaysia Medical Centre, Selangor (Urban)	Male and female patients aged 40+ with new onset of rectal bleeding recruited from the University Kembangan Malaysia Medical Centre	80	*Tool*: Self-developed, validated questionnaire	Outcome 1) Awareness of CRC Symptoms	Outcome 1: The findings show that there is a lack of awareness of colorectal cancer among subjects. Recommendation: We need to emphasise public education among people at risk for colorectal cancer. This is important to change people's behaviour as this will lead to early detection of cancer other than knowledge.

Table 4.1: Continued

Authors (Year)	Study design and study area	Study population and Study setting	Sample size (n)	Survey tool	Outcome assessed [a]	Outcomes and Recommendation
Harmy et al. (2011) Yusoff et al. (2012)	a) Cross-Sectional Study b) West Malaysia (Urban)	Male and female outpatients aged 50+ recruited from 44 health clinics	1905	*Tool:* Self-developed, validated questionnaire	Outcome 1) Awareness of CRC Symptoms Outcome 2) Barriers to CRC screening	Outcome 1: Most patients with moderate risk for colorectal cancer had relatively low awareness of CRC symptoms. Outcome 2: Most patients have a lot of barriers to colorectal cancer screening. Further, they even did not undergo any colorectal cancer screening. Recommendation: A health program is necessary with structured government and community-endorsed key messages to the general public on the importance and effect of colorectal cancer, invitations to screening uptake, access to endoscopic and non-endoscopic screening, and prompt follow-up for those with positive screening tests.
Tin et al. (2013)	a) Cross-Sectional Study b) Perak (Rural)	Male and female aged 18+ recruited from households	2379	*Tool:* Bowel CAM questionnaire	Outcome 1) Awareness of CRC Symptoms	Outcome 1: The awareness of colorectal cancer symptoms and risk factors among the Malaysian rural populations is meagre. Recommendation: An extensive health education campaign on colorectal cancer awareness is urgently needed to enhance people's knowledge and encourage them to seek medical assistance.

Table 4.1: Continued

Authors (Year)	Study design and study area	Study population and Study setting	Sample size (n)	Survey tool	Outcome assessed [a]	Outcomes and Recommendation
Naing et al. (2014)	a) Cross Sectional Study b) Sendayan town, Negeri Sembilan (Suburban)	Male and female aged 18+ recruited from households	260	*Tool:* Self-developed questionnaire	Outcome 1) Awareness of CRC Symptoms Outcome 2) Barriers to CRC screening	Outcome 1: The awareness of colorectal cancer symptoms was adequate among participants Outcome 2: The awareness of colorectal cancer screening was deficient. There are more than 50% of respondents have barriers to colorectal cancer screening. Recommendation: A health education on colorectal cancer by including information on available screening tests and the benefits of early screening for CRC.
Al-Naggar et al. (2015)	a) Cross-Sectional Study b) Umra Private Hospital, Selangor (Urban)	Male and female patients recruited from the outpatient's clinic	187	*Tool:* Self-developed questionnaire	Outcome 1) Barriers to CRC screening	Outcome 1: The significant barriers reported in this study were fear of pain and embarrassment.

Table 4.1: Continued

Authors (Year)	Study design and study area	Study population and Study setting	Sample size (n)	Survey tool	Outcome assessed [a]	Outcomes and Recommendation
Mohd Suan et al. (2015)	a) Cross Sectional Study b) Bayan Lepas, Georgetown, Sungai Petani, Ipoh, Perak, Damansara, Petaling Jaya, Bandaraya Melaka, Johor Bahru (Urban)	Male and female recruited from shopping malls	2408	*Tool:* Adapted questionnaire from Harewood et al. (2009) (Harewood et al., 2009)	Outcome 1) Awareness of CRC Symptoms	Outcome 1: The awareness of colorectal cancer symptoms was good, but only 37.5% of participants were willing to pay their own money to get an early Colonoscopy. Recommendation: More cancer education programmes for rural populations with greater engagement of family physicians and primary care doctors should be encouraged.
Yan et al. (2017)	a) Cross-Sectional Study b) Serdang Hospital, Selangor (Suburban)	Male and female aged 18+ who accompanied patients recruited from the outpatient clinic	308	*Tool:* Bowel CAM questionnaire	Outcome 1) Awareness of CRC Symptoms	Outcome 1: The awareness of CRC symptoms and risk factors was relatively good among the respondents. Recommendation: This research provides information on the formulation of effective colorectal cancer prevention methods in non-urban areas and various stakeholders, such as counsellors, educators, and medical professionals.

Table 4.1: Continued

Authors (Year)	Study design and study area	Study population and Study setting	Sample size (n)	Survey tool	Outcome assessed [a]	Outcomes & Recommendation
Sindhu et al. (2019)	a) Cross-Sectional Study b) Klang Valley, Selangor (Urban)	Male and female patients aged 18+ recruited from government health clinics	426	*Tool*: Bowel CAM questionnaire	Outcome 1) Awareness of CRC Symptoms	Outcome 1: Awareness of colorectal cancer symptoms is low among the urban population of Klang Valley. Recommendation: Colorectal cancer awareness programmes should be increased to enhance awareness of colorectal cancer symptoms, significantly raising confidence in the recognition of symptoms.
Schliemann et al. (2020)	a) Cross Sectional Study b) Rawang, Selangor (Rural & Sub-urban)	Male and female aged 40+ recruited from household	954	*Tool*: Bowel CAM questionnaire	Outcome 1) Awareness of CRC Symptoms	Outcome 1: The awareness of colorectal cancer symptoms is shallow among Malaysia's targeted population at the baseline study. Recommendation: Further research is required to identify the proper communication channel and tailoring required to reach Malaysians, such as people without formal education and the older population.

Table 4.1: Continued

Authors (Year)	Study design and study area	Study population and Study setting	Sample size (n)	Survey tool	Outcome assessed [a]	Outcomes and Recommendation
Mei Wai Chan et al. (2021)	a) Cross-Sectional Study b) Penang (Urban)	Male and female patients aged 50+ recruited from Angsana Health Clinic	546	*Tool:* Not mentioned in the article	Outcome 1) Barriers to CRC screening	Outcome 1: The main reason for refusal of CRC screening was self-perceived non-vulnerability, "I am healthy." Recommendation: The standardised brief health education is inadequate to stimulate CRC screening adherence. Future interventions will require an in-depth understanding of patients' beliefs, risk perception, and affective responses.
Nur-Nadiatul-Asyikin Bujang et al. (2021)	a) Cross-Sectional Study b) Hulu Langat district, Selangor (Urban & Suburban)	Male and female patients aged 50+ recruited from government health clinics	508	*Tool:* validated and adapted questionnaire by the Asia Pacific CRC Working Group	Outcome 1) Barriers to CRC screening	Outcome 1: Among average-risk individuals willing to undergo CRC screening, doctor recommendations were an important factor prompt a positive action for screening, while a negative perception of the test posed a significant barrier to the uptake of iFOBT. Recommendation: Further public education is needed in Malaysia regarding the possibility of asymptomatic colorectal cancer in its early stages, which can be detected through iFOBT screening.

Table 4.1: Continued

Kogila et al. (2022)	a) Focus Group Discussion b) Segamat, Johor (Suburban & Rural)	Males and females aged 60 -69	86	*Tool:* Semi-structured topic guide	Outcome 1) Barriers to CRC screening	Outcome 1: Primary care physicians play a crucial role in reducing patients' misperceptions, recommending screening to patients, enhancing attendance, and improving the uptake of CRC screening. Recommendation: There is a need for further research to investigate adherence by doctors to clinical guidelines about CRC screening in the ethnically diverse population of Malaysia.

[a]Only outcome measures of interest for this systematic review are summarised here (some studies included additional measures). For household surveys, refer to the participants who lived in the household from selected districts, villages, or housing estates.

4.2.3 Quality of the selected Colorectal Cancer studies

Table 4.2 presents a summary of the quality assessment of studies using the JBI Critical Appraisal Tool. Seven studies were classified as high quality, while the remaining five were rated as medium quality. The qualitative study also received a high-quality rating according to the evaluation criteria.

Table 4.2: Study Quality of the Selected Studies According to JBI Criteria for Cross Sectional Studies

Author (Year)	Q1[a]	Q2[b]	Q3[c]	Q4[d]	Q5[e]	Q6[f]	Q7[g]	Q8[h]	Score	Percentage (%)
Hilmi et al. (2010)	No	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6/8	75.0%
Hashim et al. (2011)	Yes	No	Yes	Yes	Unclear	No	Yes	Yes	5/8	62.5%
Harmy et al. (2011)	Yes	Yes	Yes	Yes	Yes	No	Unclear	Unclear	5/8	62.5%
Yusoff et al. (2012)	Yes	Yes	Yes	Yes	Yes	No	Unclear	Yes	6/8	75.0%
Tin Tin Su et al. (2013)	No	Yes	Yes	NA	Yes	Yes	Yes	Yes	6/8	75.0%
Naing et al. (2014)	Yes	Yes	Yes	NA	Yes	No	Unclear	Yes	5/8	62.5%
Al-Naggar et al. (2015)	No	Yes	Yes	NA	Yes	Yes	Unclear	Unclear	4/8	50.0%
Mohd Suan et al. (2015)	No	Yes	Yes	Yes	Yes	No	Unclear	Yes	5/8	62.5%
Yan et al. (2017)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	7/8	87.5%
Sindhu et al. (2019)	Yes	Yes	Yes	NA	Yes	No	Yes	Yes	6/8	75.0%
Schliemann et al. (2020)	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	7/8	87.5%
Mei Wai Chan et al. (2021)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	7/8	87.5%

Q1aWere the criteria for inclusion in the sample clearly defined?
Q2bWere the study subjects and the setting described in detail?
Q3cWas the exposure measured in a valid and reliable way?
Q4dWere objective, standard criteria used for measurement of the condition?
Q5eWere confounding factors identified?
Q6fWere strategies to deal with confounding factors stated?
Q7gWere the outcomes measured in a valid and reliable way?
Q8hWas appropriate statistical analysis used?

Table 4.3: Study Quality of the Selected Studies According to JBI Criteria for Qualitative Studies

Author (Year)	Q1[a]	Q2[b]	Q3[c]	Q4[d]	Q5[e]	Q6[f]	Q7[g]	Q8[h]	Q9[i]	Q10[j]	Score	Percentage (%)
Kogila et al. (2022)	Yes	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	9/10	90%

Q1[a]Is there congruity between the stated philosophical perspective and the research methodology?
Q2[b]Is there congruity between the research methodology and the research question or objectives?
Q3[c]Is there congruity between the research methodology and the methods used to collect data?
Q4[d]Is there congruity between the research methodology and the representation and analysis of data?
Q5[e]Is there congruity between the research methodology and the interpretation of results?
Q6[f]Is there a statement locating the researcher culturally or theoretically?
Q7[g]Is the influence of the researcher on the research, and vice- versa, addressed?
Q8[h]Are participants, and their voices, adequately represented?
Q9[i]Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?
Q10[j]Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?

4.2.4 Findings of the Selected Colorectal Cancer Studies

4.2.4.1 Awareness of symptoms

Table 4.4 shows the list of CRC symptoms extracted from the ten studies (Harmy et al., 2011b; Hashim et al., 2010; Hilmi et al., 2010a; M. A. Mohd Suan et al., 2015; Naing et al., 2014a; Schliemann, Paramasivam, et al., 2020; Sindhu et al., 2019; Su et al., 2013b; Yan et al., 2017; Yusoff et al., 2012b). Nine out of ten (90%) CRC studies assessed awareness of 13 CRC symptoms. The most frequently reported symptoms of CRC were 'change in bowel habits (new-onset diarrhoea or constipation),' 'bleeding and/or bleeding from the back passage,' and 'weight loss.' The most frequently recognised symptoms were 'blood in stool' (40.6% - 86.9%), 'change in bowel habits (new-onset diarrhoea or constipation)' (28.4% - 86.6%), abdominal pain (31.4% - 85.6%) and 'weight loss' (9.3% - 83.4%). Out of 13 CRC symptoms, more than 50% of participants in four out of eight studies recognised ten symptoms, with the exceptions of 'piles' (49.2%), 'mucus in stool' (2.2%), and 'tiredness/anaemia' (27.7% - 35.1%), which were recognised by less than 50% of participants. Moreover, 'piles,' 'constipation,' 'mucus in stool,' and 'loss of appetite' are CRC symptoms that have only been reported in a single study.

Table 4.4: CRC symptoms awareness

Colorectal Cancer	Findings[a]
Symptoms	
Piles	49.2%(Harmy et al., 2011a)
Constipation	53.4%(Harmy et al., 2011a)
Change in bowel habit (new onset diarrhoea or constipation)	28.4%(Tin Tin et al., 2013), 32.9%(Sindhu et al., 2019), 37.5% (Hilmi et al., 2010b), 45.9%(Schliemann, Paramasivam, et al., 2020), 50.3% (Yan et al., 2017), 67.3% (Naing et al., 2014a), 86.6% (Mohd Azri Mohd Suan et al., 2015)
Incomplete emptying of bowel	2.1%(Sindhu et al., 2019), 26.7%(Tin Tin et al., 2013), 31.2% (Yan et al., 2017), 66.8%(Harmy et al., 2011a) , 45.2(Schliemann, Paramasivam, et al., 2020)
Blood in the stool	33.3%(Sindhu et al., 2019), 40.6% (Tin Tin et al., 2013), 56.8% (Yan et al., 2017), 86.9% (Mohd Azri Mohd Suan et al., 2015) , 54%(Schliemann, Paramasivam, et al., 2020)
Bleeding and/or Bleeding from back passage	11.5%(Sindhu et al., 2019), 34.3% (Hilmi et al., 2010b), 37%(Tin Tin et al., 2013), 46.4%(Schliemann, Paramasivam, et al., 2020), 63.4%(Naing et al., 2014a), 71.1% (Yan et al., 2017), 71.9% (Harmy et al., 2011a)
Mucus in stool	2.2%(Hilmi et al., 2010b)
Difficulties swallowing	35.4%(Harmy et al., 2011a)
Lump in abdomen	2.3%(Sindhu et al., 2019), 35.5%(Tin Tin et al., 2013), 51.0%(Yan et al., 2017), 74.4%(Harmy et al., 2011a), 49.0%(Schliemann, Paramasivam, et al., 2020)
Abdominal pain	31.4%(Hilmi et al., 2010b), 36.1%(Tin Tin et al., 2013), 38.5%(Sindhu et al., 2019), 51%(Schliemann, Paramasivam, et al., 2020), 58.1%(Yan et al., 2017), 85.6%(Mohd Azri Mohd Suan et al., 2015)
Loss of appetite	63.5%(Harmy et al., 2011a)
Weight loss	9.3%(Hilmi et al., 2010b), 23.7%(Sindhu et al., 2019), 33.1% (Tin Tin et al., 2013), 50%(Yan et al., 2017), 51.8%(Schliemann, Paramasivam, et al., 2020), 64.8%(Harmy et al., 2011a), 83.4%(Mohd Azri Mohd Suan et al., 2015)
Tiredness/Anaemia	14.6%(Sindhu et al., 2019), 27.7% (Tin Tin et al., 2013), 35.1%(Yan et al., 2017), 38.8%(Schliemann, Paramasivam, et al., 2020)

[a] Proportion of participants (%) who reported awareness about the following symptoms

4.2.4.2 Barriers to CRC screening

The six studies (Chan et al., 2021; Harmy et al., 2011b; Hilmi et al., 2010a; Naing et al., 2014b; Ramanathan et al., 2022; Yusoff et al., 2012b) have reported on 18 types of barriers to CRC screening. The most extensively studied barrier to CRC screening was 'fear of result' (27.6% - 32.1%). The most widely expressed barriers to CRC screening were 'don't know if I should have a faecal occult blood test (FOBT)' (50.8%), 'FOBT is a painful test' (51.5% - 53.5%), 'screening is embarrassing' (35.2% - 55.1%), 'fear of

discomfort' (30% - 63.8%) and 'expensive' (22.6% - 53.4%). In addition, a qualitative study reported that waiting time in the clinic, transportation, emotional barriers, and concerns about posting stool samples are barriers to CRC screening.

Table 4.5: Barriers to CRC screening

Colorectal Cancer	**Findings[a]**
Barriers to screening (Quantitative Study)	
I do not know if I should have a faecal occult blood test (FOBT)	50.8%(Redhwan A. Al-Naggar et al., 2015)
FOBT is not necessary	46.5%(Redhwan A. Al-Naggar et al., 2015), 4.5%
The doctor did not recommend FOBT	11.2% (Yusoff et al., 2012a), 35.3% (Redhwan A. Al-Naggar et al., 2015)
I did not do FOBT because I do not have a health problem	40.6% (Redhwan A. Al-Naggar et al., 2015), 48.9% (Chan et al., 2021)
FOBT[b] is a painful test	51.5%(Harmy et al., 2011a), 53.5% (Redhwan A. Al-Naggar et al., 2015)
FOBT[b] embarrassing	61.5%(Harmy et al., 2011a), 5.7%(Chan et al., 2021)
FOBT[b] cause side effect	54.6%(Harmy et al., 2011a)
FOBT[b] troublesome	54.6%(Harmy et al., 2011a)
FOBT[b] expensive	53.1%(Harmy et al., 2011a)
FOBT[b] uncomfortable	51.9%(Harmy et al., 2011a)
FOBT[b] fear of the result	54.3%(Harmy et al., 2011a), 12.7%(Chan et al., 2021)
FOBT[b] time consuming	45.7%(Harmy et al., 2011a), 22.2%(Chan et al., 2021)
Colonoscopy[b] embarrassing	67.7%(Harmy et al., 2011a)
Colonoscopy[b] cause side effect	48.8%(Harmy et al., 2011a)
Colonoscopy[b] time consuming	34.7%(Harmy et al., 2011a)
Colonoscopy[b] expensive	35.4%(Harmy et al., 2011a)
Colonoscopy[b] uncomfortable	29.1%(Harmy et al., 2011a)
Colonoscopy[b] painful	46.5%(Harmy et al., 2011a)
I do not think that flexible sigmoidoscopy is necessary	41.2% (Redhwan A. Al-Naggar et al., 2015)
I have no symptoms of colorectal cancer	12.8% (Yusoff et al., 2012a), 39.0% (Redhwan A. Al-Naggar et al., 2015)
Screening is embarrassing	35.2% (Yusoff et al., 2012a), 55.1% (Redhwan A. Al-Naggar et al., 2015)
Fear of result	27.6% (Naing et al., 2014a), 29.8% (Yusoff et al., 2012a), 32.1% (Redhwan A. Al-Naggar et al., 2015)
Fear of discomfort	30% (Yusoff et al., 2012a), 63.8% (Naing et al., 2014a)
Fear of side effects	41.4% (Naing et al., 2014a)
Expensive	22.6% (Yusoff et al., 2012a), 53.4% (Naing et al., 2014a)

Table 4.5: Continued

Colorectal Cancer	Findings[a]
Barriers to screening (Quantitative Study)	
Not bothered	31.9% (Yusoff et al., 2012a)
Busy	33.4% (Yusoff et al., 2012a)
Time-consuming	21.8% (Yusoff et al., 2012a)
Do not understand the procedure	18.5% (Yusoff et al., 2012a)
Do not know how to go about screening	17.1% (Yusoff et al., 2012a)
Troublesome	29.4% (Yusoff et al., 2012a)
Barriers to screening (Qualitative Study)	
Barriers to screening (at a clinic) • Waiting times • Transportation Financial concerns • Cost of treatment and medications at private hospitals or clinics Emotional barriers • Embarrassment • Disgust Concerns about posting stool sample • Unreliability of postal services • Distrust of postal service • Illiteracy and language barrier	

[a] Proportion of participants (%) who reported the following barriers towards breast or colorectal cancer screening
[b] Some studies specified the screening test i.e. FOBT or Colonoscopy

4.2.5 Finding Summary of Systematic Review

Cancer screening is essential for individuals over 40 years old to facilitate early detection of colorectal cancer (CRC) and reduce mortality rates. Research indicates that awareness of CRC symptoms and risk factors is alarmingly low among the Malaysian public. For instance, only 40.6% of participants identified “blood in stool” as a warning sign. Common misconceptions, such as the belief that CRC primarily affects men, further exacerbate the issue. There is a significant gap in understanding the early symptoms of CRC, which could enable timely detection. Several barriers prevent people from undergoing regular cancer screenings. These include a lack of awareness about the importance of screening, cultural norms, emotional concerns, and limited access to healthcare services. To combat this lack of awareness and these barriers, comprehensive cancer awareness and screening programs are urgently needed at both national and regional levels.

To overcome these challenges, health education programs led by trained healthcare professionals should be implemented. These programs must focus on raising awareness about the symptoms of breast and colorectal cancer and highlight the significance of regular screenings.

To effectively address the lack of awareness, targeted public education campaigns are crucial. A notable initiative is The Be Cancer Alert Campaign (BCAC) in Malaysia, which has developed, validated, implemented, and evaluated a culturally adapted mass media campaign. By addressing the barriers to cancer screening and implementing these strategies, we can enhance the uptake of screenings for both breast and colorectal cancer, ultimately leading to earlier detection and improved outcomes for those affected by these diseases.

4.3 Study Objective 2: To develop, validate, and implement the colorectal cancer awareness mass-media campaign with adapted Malaysian culture as an intervention

4.3.1 Development and validation of an intervention: Malaysian cultural adaptation of colorectal cancer awareness mass-media campaign

4.3.1.1 Stage 1– Information Gathering

Malaysia is a diverse country with three multi-ethnic populations, and Malays are the majority of the population (69.3%), followed by Chinese (22.8%) and Indians (6.9%) (Department of Statistics Malaysia, 2020). In Malaysia, religion played a significant role with Islam was practised by a large part of communities, especially among Malays (61.3%), followed by Buddhism (19.8%), Christianity (9.2%), and Hinduism (6.3%) (Department of Statistics Malaysia, 2011). Most cancer studies by Southeast Asian populations discovered that the significant role of religion and cultural beliefs in cancer prevention and early detection was an urge to address social stigma and fear about cancer

as barriers to earlier detection (Anderson de Cuevas et al., 2018; Lim et al., 2015). Daher et al. found that women from Middle Eastern countries where Islam is the predominant religion and who have migrated to Malaysia are often hesitant to discuss breast or gynaecological issues with their healthcare providers, and they are also more reluctant to undergo physical examinations (Daher, 2012).

Furthermore, it has been demonstrated that Southeast Asian Muslim women who immigrated to the United States discovered that preventive screening is relatively new to them. They believed that illness is witnessed as fate (Anderson de Cuevas et al., 2018; Islam et al., 2017) and known as a punishment from god (Padela et al., 2014). According to socio-cultural norms, Muslim women widely accept that they must consider their families' health over their own (Islam et al., 2017). While religion and culture seem to be a barrier to early diagnosis of cancer, a study found a correlation between spirituality, religion, and better beneficial physical health in cancer patients (Jim et al., 2015). The current evidence and local discussions recommend that religious factors be considered when developing cancer-related interventions. Healthcare practitioners and researchers should also concentrate on describing the importance of cancer prevention.

Table 4.6: Stage 1- Information gathered on the targeted communities of Northern Ireland and Malaysia

	Be Cancer Aware	Be Cancer Alert	Explanation
Study Setting			
Country	Northern Ireland	Malaysia Study area: Rawang, Selangor State	Different national TV channels, radio stations, and printed materials as advertising mediums required
Population statistics	1.88 million	32.4 million (Malaysia, 2018) Study area: ~200,000	Although the study population in Malaysia (Rawang) is smaller than in Northern Ireland, the selected study area's population density is higher.
Socioeconomic status (Djayeola, 2018)	High-income country	Upper middle-income country	Different prevention resources and early diagnostic services are available.
Health Care System	National Health Care System (NHS)	System of dual-tier health care (82% of inpatient care and 35% of ambulatory care covered by the public sector)	The cost of cancer treatment is much more essential for Malaysians (not all cancer treatment costs are covered in Malaysia), as UK citizens get paid medical care through the NHS.
Study population			
Age	Across all ages with a primary target group aged 50 years and above	Aged 40 years and above	Since the target populations were men and women aged 40 years and above, we recruited only from this age group.
Ethnicity (most common)	Northern Irish	Malaysian (Malay/Chinese/ Indian)	It needs to be taken into consideration when creating visual materials. Stigmas, beliefs, and roles of the family may differ between countries.

Table 4.6: Continued

	Be Cancer Aware	Be Cancer Alert	Explanation
Study population			
Language	English	Malay, English, Cantonese/Mandarin/ Hokkien, Tamil	Although Malaysia's national language is Malay, some families and communities can only communicate in English/Tamil/Chinese and are uncomfortable speaking in other tongues.
Religion	Christianity (Catholic, Protestant)	Islam, Buddhism, Christianity, Hinduism	Religion is likely to impact the beliefs and health behaviours of several people.
Socioeconomic status	All socioeconomic groups	All socioeconomic groups	Needs to be taken into account in the use of advertising channels (location, stations, etc.) and language
Rural/Urban	Rural, semi-urban, and urban communities	Semi-urban and urban communities	Consider advertisement placement; for example, TV covers rural population as well, but printed materials as advertising are probably less cost-effective
Cancer risk			
Colorectal cancer incidence rate (percentage of all cancer cases/crude rate/age-standardised rate per 100,000)	Percentage: 9.5 (male) and 8.5 (female) Crude rate: 71.7 (male) and 56.5 (female) Age-standardised rate per 100,000: 93.8 (male) and 62.5 (female)	Percentage: 16.3 (male) and 10.7 (female) Crude rate: 11.7 (male) and 9.5 (female) Age-standardised rate per 100,000: 14.6 (male) and 11.1 (female)	Colorectal cancer is a severe burden for Northern Ireland and Malaysia's population and the healthcare system.
Colorectal cancer mortality (crude rate/world age-standardised rate per 100,000)	Crude rate / World age-standardised rate per 100,000: 23.8/10.7	Crude rate / World age-standardised rate per 100,000: 10.7/ 11.2	Cancer mortality is more elevated in Malaysia than incidence (i.e., more people are likely to die from cancer in Malaysia).

Table 4.6: Continued

	Be Cancer Aware	Be Cancer Alert	Explanation
Cancer risk			
Colorectal cancer incidence according to cancer detection stage (incidence %)	Stage 1: 20.0%; Stage 2: 28.6%; Stage 3: 29.2 %; Stage 4: 22.2%; Unknown: 10.2%	Stage 1: 10%; Stage 2: 24–25%; Stage 3: 30%–32%; Stage 4: 33%–36%	Colorectal cancer cases in Malaysia are detected later than those in Northern Ireland.
Age-specific colorectal cancer incidence rate	Most cancer cases presented after the age of 65 years	Most patients presented after the age of 60 years	Colorectal cancer in Malaysia's men and women occurs earlier than in Northern Ireland.
Screening guidelines			
Colorectal cancer screening	Faecal occult blood tests are available every two years for men and women aged 60 and 74 (population-based screening).	Men and women aged 50 to 75 or older should undergo an annual faecal occult blood test (opportunistic screening).	The UK's screening uptake is already higher because of regular screening invitations and citizens familiarizing themselves with the situation and the screening more likely.

4.3.1.2 Stage 2 – Preliminary content and design of campaign materials based on expert panel discussion

The content of campaign materials was discussed to ensure the language, meaning, and context comply with the cultural pattern and acceptability of the intervention's key messages.

Several issues related to language, such as understanding and appropriateness, have been pinpointed during the expert panel discussion. The expert panels regarded that the key messages had to be changed according to Malaysian culture, and they pointed out several words that could not be easily understood or misconstrued and needed changing. These words have been improved by switching to the synonym while preserving the key

message's original meaning. For example, In Malaysia, "general practitioners" refer only to private healthcare providers and must be changed to "doctors."

"I think it better to change the GP to a Doctor…" (Doctor, MOH, and Director of NCSM)

"I do not prefer to use 'poo' because this word is widely referred to or used by kids, prefer to change 'poo' to 'stool'..." (Doctor, MOH, and Director of NCSM)

The experts also deemed that more immediate "action," "catchy," and "attractive" messages and words were needed as impactful key messages for Malaysians. These messages are essential and designed to provide knowledge and the importance of immediate action for CRC cancer screening. For example:

"I think using the word cured will be more catchy and attract more attention…" (Doctor, MOH)

"I think listen to body is too weak…" (Director of NCSM)

Furthermore, the terminology of words from key messages relating to the health system was adjusted to make them culturally relevant to Malaysians. The key message "blood in your poo or looser poos for six weeks or more" was highlighted below:

"I do not prefer to use 'poo' because this word is widely referred to or used by kids, prefer to change 'poo' to 'stool'..." (Doctor, MOH, and Director of NCSM)

"Six weeks is too long…" (Dental, Director & Adviser of Oral Cancer Research & Coordinating Centre)

One dental expert and director of the Oral Cancer Research & Coordinating Centre perceived that the CRC survival rate differed from Northern Ireland and suggested changing it to a percentage. The percentage will be direct and easily understood by

Malaysians. The examples of changes from the expert panel discussion on key messages are shown in Table 4.7.

Table 4.7: Findings and quotes from the expert panel discussion (Key messages)

Comments by the experts for key messages	Description
"I think it better to change the GP to a Doctor…" *(Doctor, MOH, and Director of NCSM)*	"GP" refers only to private health care providers in Malaysia and needs to be changed to "doctor."
"I do not prefer to use 'poo' because this word is widely referred to or used by kids; prefer to change 'poo' to 'stool'…" *(Doctor, MOH, and Director of NCSM)*	"Poo" is not commonly used in Malaysia and needs to be changed to "stool."
"Six weeks is too long…" *(Dental, Director & Adviser of Oral Cancer Research & Coordinating Centre)*	Malaysians should visit a doctor sooner rather than after six weeks.
"I think it better to check on Malaysia CRC survival statistics and prefer to change it to a percentage (%)..." *(Dental, Director & Adviser of Oral Cancer Research & Coordinating Centre)*	To change the percentage of survival statistics for Malaysia.
"I think using the word cured will be more catchy and attract more attention…" (Doctor, MOH)	Strengthen the message by saying, "cancer can be cured if found and treated early."
"I think to listen to body is too weak…" (Director of NCSM) *"Listen to the body; bodies have many parts; which part are we referring to?" (Communication manager, Perception Management)*	The message "listen to your body" is too soft and does not call for action.

Table 4.8 shows the experts' comments and changes on radio and television advertisements during the expert panel discussion. The experts decided that a series of 30-second radio advertisements were appropriate for conveying the CRC key messages. They deemed that the radio advertisement concept specifically changed to the Malaysian

style and adapted to local culture. These changes will easily attract local people to wait and listen to the advertisement till the end. Certain words are suggested to change as Malaysians are unfamiliar with them, such as

"Basically, Malaysians won't use the 'number two'; instead, use a long call or nature's call..."

(Doctor, MOH, and Director of NCSM).

The advertisement script proposed to be more direct and shorter, making Malaysia easy to understand.

The expert panels have pointed out that the BCA television advertisement focuses on attraction instead of cultural acceptability, which requires changes to incorporate elements that are more culturally acceptable and suitable for Malaysians. Besides, experts prefer to have Malaysians or celebrities in the television advertisement. The final decision in this discussion was to have ordinary people with their daily environment and activities emphasising the family's values.

Table 4.8: Findings and quotes from the expert panel discussion (Media content)

Comments by the experts for Media content	Description
Radio advertisement	
"I think it better to have a 30-second advertisement…" *(Dental, Director & Adviser of Oral Cancer Research & Coordinating Centre and Family medicine, UMMC)*	40-second is too long (change to 30-second)
"Prefer to have a concept which can adapt local culture…" *(Communication manager, Perception Management)*	Adapt the concept to local culture.
"Basically, Malaysians won't use the 'number two' instead, use a long call or nature's call..." *(Doctor, MOH, and Director of NCSM)*	Malaysians may not understand "number two."
TV advertisement	
"I do not think, so it will be culturally acceptable to show someone sitting in the toilet…" *(Dental Specialist, UMMC)*	Concerns with the cultural acceptability among Malaysians of depicting a person seated on the toilet.
"Prefer to have local ethnicity person to be in the TV advertisement…" (Director of NCSM)	Replace the person in the TV advertisement with a Malaysian.
"Prefer to change the concept and try to make it more culturally acceptable by Malaysian…" *(Communication manager, Perception Management)*	Make the concept more culturally acceptable.
"Better get straight to the point and easily understand..." *(Doctor, MOH, Director of NCSM and Dental, Director & Adviser of Oral Cancer Research & Coordinating Centre)*	Messages should be more direct, and sentences need to be shorter.

Concerning posters, experts recommended that the text of the poster be reduced because the BCA's poster was too wordy. The EPD decisions recommended that 'portray' include all three major ethnicities in Malaysia.

Table 4.9: Findings and quotes from the expert panel discussion (Printed material content)

Comments by the experts for Printed materials	Description
Printed materials	
"Malaysians won't read too long sentences; better change to a local flavour..." (Doctor, MOH)	Too wordy; less text preferred.
"This poster is more on UK culture, and it's better to change according to Malaysian context…" (Director of NCSM)	Make the poster culturally suitable (i.e., replace the person in the poster with a Malaysian to deliver the message).

*GP – General Practitioner

4.3.1.3 Stage 3 – Preliminary testing of the campaign material content and design among the selected community based on Group Discussion

Table 4.10 summarises the outcome of the group discussion. The group discussion participants from high- and low-income backgrounds found certain words difficult to understand, for example, "nagging." Those identified terms were amended by accepting their opinion. Overall, statistics and numbers should be retained if scientific support is available. Participants also highlighted that they did not regularly check their stools.

Table 4.10: Findings from group discussions (Key messages)

Quote (Key messages)	Explanation
"Usus (colon) means? Usus (colon) is what?.." (*Chinese, Female, Low Income)*	Difficulty in understanding what colorectal cancer is.
"If there is an image that is used. […] Do you have a poster to help people understand colorectal?..." (*Indian, Female, High Income)*	Include a diagram/image of the colon to aid understanding.
"What do you mean by nagging?.." (Chinese & Indian, High Income)	Difficult word: "nagging."
"We just do our business and flush; we do not look at it..." (Chinese Male High Income)	People usually do not look at their stools.

According to group discussion participants, the radio advertisement script was too wordy and lengthy. They recommended the script have a straightforward message with fewer catchy words. The majority of participants prefer using the local voice and slang in their advertisements. In addition, some participants suggested changing the radio advertisement concept to a conversation style with dialogue between two individuals.

A few participants reported that presenting television advertisement content in a way that scared people would be an effective method. In contrast, other participants believed that the message should encourage people to visit a doctor if they notice any symptoms related to CRC. The participants reached a consensus that cancer survivors should deliver the key messages on all mass-media channels instead of doctors. Furthermore, the participants agreed that the key messages should be delivered in their respective ethnic languages, such as Malay, Chinese, and Tamil.

Table 4.11: Findings from group discussions (Media content)

Quote (Media content)	Explanation
Radio advertisement	
"I feel this is a bit dull; the impact is not there […]" (Chinese, Male, High Income) *"I think a simpler version could be better; use lesser words […]" (Indian, Female, High Income)*	Recommended the script to have a straightforward message with fewer catchy words.
"I think if he speaks in Tamil with local slang will be easier to understand by a less educated group of people […]" (Indian, Male, High Income)	The voice and slang of the advertisement in the local language
"Should not be a long script; it's better to mention as main points with catchy words […]" (Chinese, Female, Low Income)	Shorten the script with more catchy words
"Make the advertisement as a dialogue concept […]" (Indian, Male, Low Income)	Recommended changing the radio advertisement concept to a conversation-style

Table 4.11: Continued

Quote (Media content)	Explanation
TV advertisement	
"Another one I see, for TV ads, mixes Chinese, Indian, and Malay to become 1 Malaysia, with 1 Malaysia message. One against cancer […]" Malay, Male, Low Income	Different ethnicities should deliver messages in local languages, that is, multicultural (Malay, Chinese, and Tamil)
"Check early is very important, that's what you tell people..." Chinese, Female, High Income	Highlight the urgency of the message to undergo screening.
"We Malaysians, if not scared, won't take action. […] Maybe a guy crying at the graveyard […] and he notices blood on his attire…" Malay, Female, High Income *"I think your poster should be giving hope and encouragement to go to [see a doctor]" Chinese, Male, Low Income*	Different opinions on whether to have a hopeful and encouraging or scary tone to the messages

During the group discussion, the participants discussed how the campaign materials could be improved. They emphasised that the posters should showcase the three main ethnic groups in Malaysia. Additionally, they suggested that the messages in the posters should be written in the respective local languages of the groups. This would make it easier for people to understand the key messages. The participants also recommended that the sentences in the posters should be shorter and more precise so as to attract people's attention and ensure that they read the messages until the end.

In terms of who should be featured in the poster, participants preferred cancer survivors over doctors. They felt that cancer survivors would be better able to convey the message and connect with the audience. Finally, participants suggested that the colon's image should be included in the poster to improve understanding.

Table 4.12: Findings from group discussions (Printed material content)

Quote (Printed Material)	Suggestions
"It will be better to have cancer survivors talk. A doctor may also be ok, but not random people without or related to cancer. Not just for the acting sake of the artist. People will know it's fake. It's better to take real patient…" (Malay, Male, High Income)	A cancer survivor is preferred over a doctor to communicate messages/ share stories. Celebrities would also attract attention.
"Cartoons are inappropriate, not serious…" (Malay, Female, Low Income)	A real person is preferred over a cartoon/animation
"When you put too many wordings, people won't stop and read it patiently. [...] Make it short lah…" (Indian, Male, High Income)	Shorten messages on posters.

The mainstream TV channels among Malaysians were TV 3 and Astro (Malay) and 8TV (Chinese), including TV3 and Vijay TV (Indian). The most popular radio channels among Malaysians were Sinars FM and Hitz FM (Malay), Lite FM, and Mix FM(Chinese), including Thr Raaga or Minnal FM (Indian). The Star (Chinese and Indians) and Harian Metro (Malay and Indians) were the two most unanimously mentioned newspapers by both ethnicities. The other most frequently mentioned newspapers were Berita Harian and Utusan Malaysia by Malays, The Sun by the Chinese, and Tamil Nesan by Indians. Most people use social media, particularly Facebook and YouTube, and propose these channels for campaign purposes.

Table 4.13: Findings from group discussions on the list of preferred media platform

Maas media	Malay	Chinese	Indian
Televisyen	TV3 Astro	8TV	TV3 Vijay TV
Radio	Sianr FM Hitz FM	Lite FM Mix FM	Thr Raaga Minnal FM
Newspaper	Berita Harian Harian Metro Utusan Malaysia	Star The Sun	Tamil Nesan Star Harian Metro
Social Media	Facebook YouTube		

4.3.1.4 Refined and finalised key massages of the Be Cancer Alert Campaign

The Be Cancer Aware key messages were altered and refined according to the suggestions given during expert panel discussion and group discussion. The finalised BCA-CRC key messages' meaning was maintained as in Be Cancer Aware, and only certain words have been modified to be more culturally significant and acceptable to Malaysians. The implementation of BCAC-CRC was described in the 4.3.2.

Table 4.14: Altered and refined key messages for the Be Cancer Alert Campaign

Be Cancer Aware	Be Cancer Alert	Justification
If you've noticed a change when you go to the loo, like blood in your poo or looser poos for six weeks or more, see your GP.	If there is blood in your stool and you are experiencing constipation or diarrhoea for several weeks, see a doctor urgently.	Words including "loo" and "poo" are not often among Malaysians, and change is needed. Symptoms need to be made more explicit. "GP" must be changed to "Doctor."
It could be nothing. But you won't know until you let your GP check.	The changes in your bowel habits could be nothing. But you won't know until you let your doctor check.	This message should be clear. "GP" must be changed to "Doctor."
9 out of 10 people survive bowel cancer when it's found early.	Colorectal cancer can be cured if it is found and treated early. Colorectal cancer is the second most common cancer in Malaysia.	Malaysians easily understand the ranking of colorectal cancer among other cancers.
Listen to your body and talk to your GP.	Watch out for the cancer signs, see the doctor, and get checked.	The message is too gentle, which has a lower impact on awareness and action; it would be better to be more specific. "GP" must be changed to "Doctor."

4.3.2 Implementation of an intervention: Malaysian Cultural Adaptation of Colorectal Cancer Awareness Mass Media Campaign

4.3.2.1 The key messages of the Be Cancer Alert Campaign – Colorectal Cancer

English Version	Malay Version
If there is blood in your stool and you are experiencing constipation or diarrhoea for several weeks, see a doctor urgently.	Sekiranya terdapat darah dalam najis anda, dan anda mengalami sembelit atau cirit-birit selama beberapa minggu, berjumpalah doctor dengan segera.
The changes in your bowel habits could be nothing. But you won't know until you let your doctor check.	Perubahan pada tabiat usus anda mungkin bukan sesuatu yang membimbangkan, tetapi anda tidak akan pasti sehingga diperiksa oleh doktor.
Colorectal cancer can be cured if it is found and treated early. Colorectal cancer is the second most common cancer in Malaysia.	Kanser usus boleh diubati jika dikesan dan dirawat dari awal. Kanser usus kanser kedua tertinggi di Malaysia.
Watch out for the cancer signs, see the doctor, and get checked.	Awasi petanda-petanda kanser, jumpalah doktor untuk diperiksa.

4.3.2.2 The detailed description of the Be Cancer Alert Campaign distribution

A local production house was chosen to create a 30-second TV commercial for CRC. The advertisement featured a local Chinese male CRC survivor and focused on promoting awareness of colorectal cancer and the importance of early detection. Based on feedback from participants in a group discussion, two Malay channels (TV3 and TV9) and one Chinese channel (8TV) were chosen to broadcast the advertisement, in order to reach the two largest ethnic groups in Malaysia. Tamil channels were not selected, as most Indian populations understood Malay and watched TV3 and TV9. The same CRC TV commercial was broadcasted on each channel, with voice-overs in different languages such as Malay and Mandarin.

The TV advertisement (Table 4.14) was telecasted on all selected channels for five weeks, from 2nd April to 6th May 2018. Besides, the advertisement was telecasted four to six times per day. The TV advertisement was also uploaded on the National Cancer Society Malaysia YouTube channel from 2nd April 2018 till now. The campaign media

soft launch event was highlighted during the television primetime slot for two minutes on TV3 (English) and TV8 (Mandarin) on 8th April 2018.

The famous radio jockeys from Astro were invited to record the radio advertisement in English and Tamil language for 30 seconds, as the duration of the advertisement was suggested by experts during an expert panel discussion. The content of the advertisement was from the experience of two cancer survivors (one male and one female) to raise awareness that CRC affects both genders. The script was mainly based on the campaign's objective: "to promote awareness of the symptoms of CRC and the importance of early detection." The recorded radio advertisements were broadcast on Lite FM (English) and Thr Raaga (Tamil), reaching out to all Malaysians who listen to English Radio stations and Indians who missed watching the CRC TV advertisement on the selected TV channels.

The radio advertisement was broadcast for two weeks (9th April– 22nd April 2018), five to seven times a day on two selected radio stations (Lite FM and Thr Raaga). Moreover, KL FM invited the researchers to give a talk and promote the BCAC-CRC during the campaign period. Throughout the talk, details such as the campaign launch, CRC symptoms, risk factors, prevention of CRC, and other related information were disseminated.

The printed campaign materials, such as posters, billboards, banners, and buntings, were printed in English and Malay with blue background colour, in line with the international CRC ribbon colour. As most participants were not aware of the colon's anatomical structure, a colon image was included in the printed materials to make them understand what a colon is. The caption "Don't be shy to check your stool" was printed in big font along with key messages about symptoms of CRC and the importance of early detection, which were included in the materials. For brochures, the key messages and the stories of CRC survivors were added with their pictures and printed in four languages

(English, Malay, Tamil, and Mandarin) with a blue background. All the printed campaign materials were enclosed in the appendix (Appendix J, K, L, M, N, and O).

All the printed materials were displayed in the study area (Rawang) throughout the campaign period (2nd April to 6th May 2018). Two billboards and a hundred street buntings were hung throughout the Rawang area, such as lamp posts, traffic lights, and other places. Besides, fifteen banners were also placed at Tesco supermarket, two government health clinics, and the residential area at Rawang, especially at the 'kampung' main entry. Finally, the posters (English and Malay) and brochures (English, Malay, Mandarin, and Tamil) were placed in all government clinics (health and community clinics) and a few selected private clinics at Rawang. Five articles regarding key messages of the BCAC-CRC were published in five different newspapers, such as Berita Harian, The Star, Kosmo, The Star (Metro South and East), and Harian Metro.

According to the participant's feedback from the group discussion, Facebook was selected as the social media campaign platform because it was the most commonly used by the target population. The social media campaign was also created with more creative and attractive infographic posts regarding the symptoms of CRC and the importance of early detection. The posts were disseminated through the National Cancer Society Malaysia (NCSM) Facebook page as they have vast numbers of followers, which can easily reach most Malaysians. There were 12 creative infographic posts regarding the BCAC-CRC campaign launch, CRC symptoms, risk factors, prevention, the importance of early detection, a campaign video, three cancer survivor stories, and a call to action. Besides that, interactive posts, such as mini-quizzes, were also created to get Malaysians to participate. Thus, most developed and shared Facebook posts are in Malay and English, except a few in Chinese and Tamil. All the posts were shared during the campaign period from 2nd April to 6th May 2018. All the Facebook posts were enclosed in the appendix (Appendix T). In addition, invited Malaysian celebrities who were ambassadors from

Yakult, Fara Fauzana, and Jack Lim posted two posts regarding our BCAC – CRC and the media soft launch event on their personal Instagram page.

A website was designed to outline the CRC campaign in English and Malay. It included information about cancer in general, symptoms, risk factors, and early detection of other cancers. In addition, they can also access all the BCAC-CRC materials and stories from cancer survivors. The website was launched in April 2018, and the website link is www.becanceralert.com. NCSM also supported a toll-free helpline for CRC campaign that offered professional advice on cancer-related matters. The reach and effectiveness of social media and the BCAC-CRC website were not evaluated during the household survey.

Table 4.15: Distribution of BCAC-CRC Campaign material at Gombak District

Time period (2018)	Media (Language)	Content	Implementation area
TV			
2nd April – 6th May 5 weeks 4 – 6 advertisements per day	Duration: 30 seconds on Media (Language): TV3 (BM), TV9 (BM), 8TV (MAN), and YouTube (BM, MAN, ENG)	Cancer survivor highlighting symptoms he experienced, the importance of family support, that CRC affects males and females, and that early detection can save lives	Nationwide
8th April Prime slot (8 pm news)	Duration: 2 minutes Media (Language): TV3 (BM) and 8TV (MAN)	Highlighting the BCAC launch, CRC symptoms, and that early detection can save lives	Nationwide
Radio			
9th – 22nd April 2 weeks 5 – 7 advertisements per day	Duration: 30 seconds Media (Language): Thr Raaga (TAM) and Lite FM (ENG)	Cancer survivors highlight CRC symptoms that CRC can be cured, that early detection can save lives, and see a doctor urgently if symptoms are noticed	i. Peninsular Malaysia ii. Central Malaysia (including Rawang)
3rd May	Radio Interview Media (Language): KL FM (ENG)	Campaign launch, CRC symptoms, risk factors/ prevention of CRC	i. Peninsular Malaysia ii. Central Malaysia (including Rawang)
Printed Materials			
2nd April – 6th May 5 weeks	Media (Language): Billboards (x2) (BM)	Displayed the colon as well as the headline 'Don't be shy to check your stool' and the slogan 'Colorectal cancer can be cured if found and treated early'	Rawang[a]
	Media (Language): Banners (x15) (BM)	*See billboards*	Residential areas in Rawang[a] Tesco in Rawang[a]
	Media (Language): Street buntings (x100) (BM)	*See billboards*	Rawang[a]

Table 4.15: Continued

Time period (2018)	Media (Language)	Content	Implementation area
Printed Materials			
2nd April – 6th May 5 weeks	Media (Language): Posters (BM and ENG)	*See billboards* + symptoms of CRC, see a doctor urgently if symptoms are noticed, the prevalence of CRC in Malaysia, age-related risk, early detection can save lives, CRC can be cured	Clinics in Rawang[a]
	Media (Language): Brochures (BM, ENG, MAN, and TAM)	*See billboards* + what is CRC symptoms of CRC, risk factors and prevention of CRC, cancer survivor story, CRC can be cured, and early detection can save lives	Clinics in Rawang[a]
14th April (x3), 16th April (x1), 19th April (x1)	5x Newspaper articles (BM and ENG), i.e., Berita Harian, The Star, Kosmo, The Star (Metro South and East), Harian Metro	*Key messages are the same as posters*	Respective areas of coverage
Social media			
	Facebook: 24 posts, including 4 boosted posts (BM, ENG, MAN, TAM) Instagram: 2 x 2 posts from Malaysian influencers Fara Fauzana & Jack Lim	What is CRC, BCAC-CRC campaign launch, symptoms, risk factors, prevention, campaign video, cancer survivor stories (x3), call to action, early detection saves lives, quiz	Nationwide

Table 4.15: Continued

Time period (2018)	Media (Language)	Content	Implementation area
Website			
	Link: www.becanceralert.com (BM and ENG)	Information about cancer in general, symptoms, risk factors, and early detection, as well as access to all BCAC-CRC materials, cancer survivor stories	Nationwide
5th April	1-hour launch event (ENG)	Stakeholders and media were invited to launch the BCAC-CRC campaign officially	University of Malaya, Kuala Lumpur

a Rawang was the study area for BCAC-CRC
Ads – advertisement, BCAC – Be Cancer Alert Campaign, BM – Bahasa Melayu, CRC – colorectal cancer, ENG- English, MAN – Mandarin, NCSM – National Cancer Society Malaysia, TAM- Tamil
(Note. This table is included from the published article (Schliemann, Paramasivam, et al., 2020)).

4.4 Study Objective 3: To determine the factors associated with the recognition of culturally adapted intervention for Be Cancer Alert- colorectal cancer campaign among the community in Rawang, Selangor

4.4.1 Recognition of any mass media campaign related to cancer awareness-raising in Malaysia in early 2018

Figure 4.2 displays the results of a study on the effectiveness of different mass-media platforms in promoting the BCAC-CRC campaign for raising cancer awareness. The study found that TV advertisements were the most viewed platform, with 20.1% of participants recognising any mass-media campaign related to cancer awareness. TV news and cancer-related TV programmes followed with 15.6% and 12.6% recognition rates, respectively. In contrast, websites were the least viewed mass-media platform, with only 1% of participants recognising any campaign related to cancer awareness.

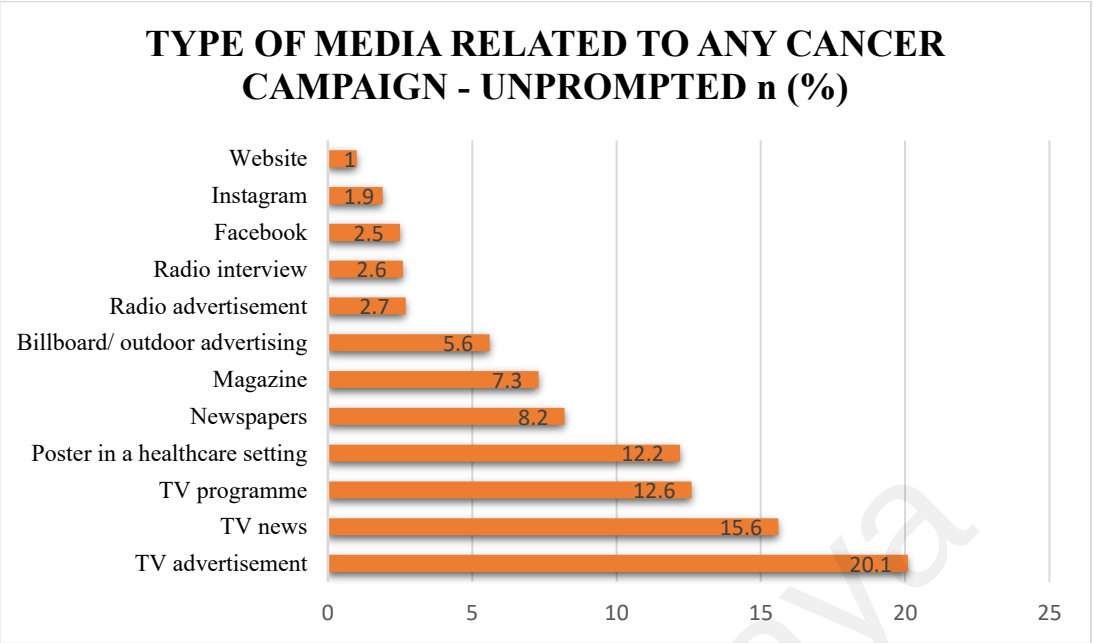

Figure 4.2: Proportion (%) of participants who recognised any mass media campaigns related to raising cancer awareness

4.4.2 The reach of BCAC-CRC among study participants

According to the research, 26% of the participants were aware of the BCAC campaign without any prompting. However, when asked directly about the campaign, 42.9% of participants recognised the BCAC-CRC TV advertisement, followed by posters (40.0%) and the campaign logo (26.0%). Among all the mass-media platforms used for BCAC-CRC, only 18.4% of participants identified the radio advertisement as the least recognised media platform. Notably, less than 10% of participants were able to recall the BCAC-CRC slogan.

Table 4.16: Frequency and percentage of participants noticed the BCAC-CRC

Statement	n (%)*
Participants who have seen/ heard about the BCAC-CRC campaign (Unprompted)	190 (26.0)
Participants who recalled the BCAC-CRC slogan (Prompted)	58 (7.9)
Participants who have seen the BCAC-CRC logo (Prompted)	190 (26.0)
Participants who have seen BCAC-CRC TV advertisement (Prompted)	313 (42.9)
Participants who have heard BCAC-CRC Radio advertisement (Prompted)	134 (18.4)
Participants who have seen the BCAC-CRC poster (Prompted)	292 (40.0)

*Participants who responded 'Yes' to each statement

Regarding our study, the majority of participants reported noticing the BCAC-CRC advertisement through posters displayed in healthcare settings, which was also the most widely accessed media channel (18.5%). TV advertisements (6.7%) were the second most accessed media platform, followed by billboard and outdoor advertising (5.6%), such as bunting or banners. Magazines, radio interviews, Instagram, and websites were the least viewed media platforms, with less than 0.5% of participants accessing them (as shown in Figure 4.3).

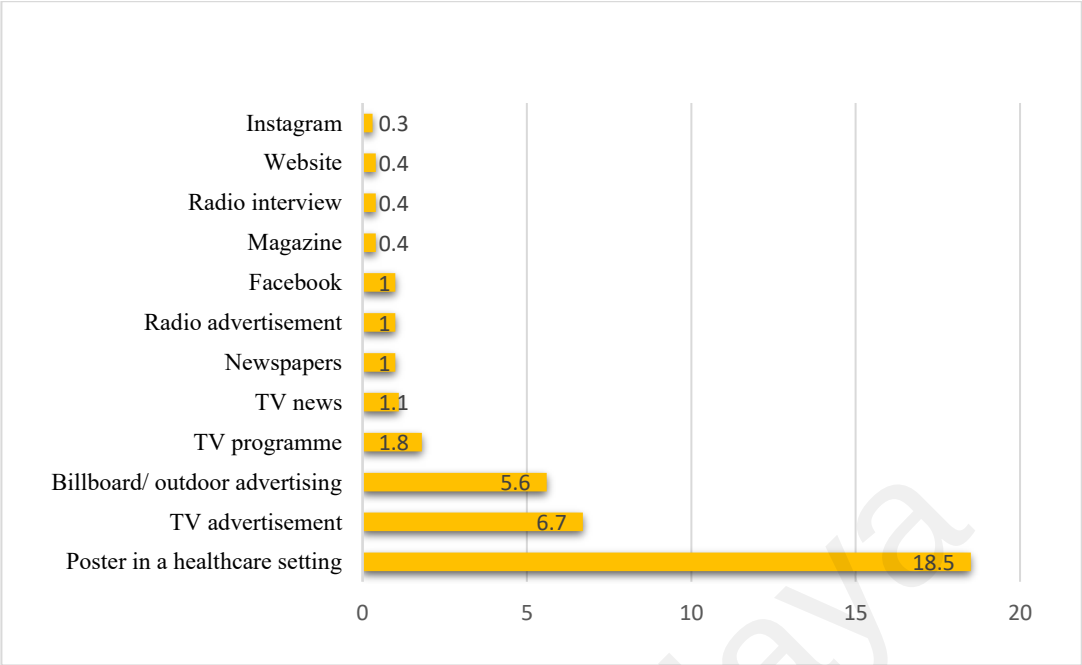

Figure 4.3: Proportion (%) of participants who noticed mass media campaigns related to the BCAC-CRC campaign (Prompted)

Figure 4.4 indicates that in Malaysia, TV advertisements were the most recognised campaign material among the major ethnicities for primary BCAC-CRC awareness. The TV advertisement's reach was highest among 'others' (65.8%), followed by Malays (55.9%) and Indians (31.2%). Printed materials were the second most recognised advertisement by 51.5% of Indians, followed by 49.5% of Malays and 27.0% of 'others.' Radio advertisement was the least recognised BCAC-CRC advertisement among Malays (11.9%), Chinese (1.6%), and 'others' (11.1%). However, it reached more than 50% among the Indian ethnicity. Except for the Indian ethnicity, the reach patterns for all were similar in that TV advertisements and printed materials were the most commonly recognised materials compared to radio advertisements. On the contrary, among Indians, printed material and radio advertisements achieved a larger reach of participants than TV advertisements.

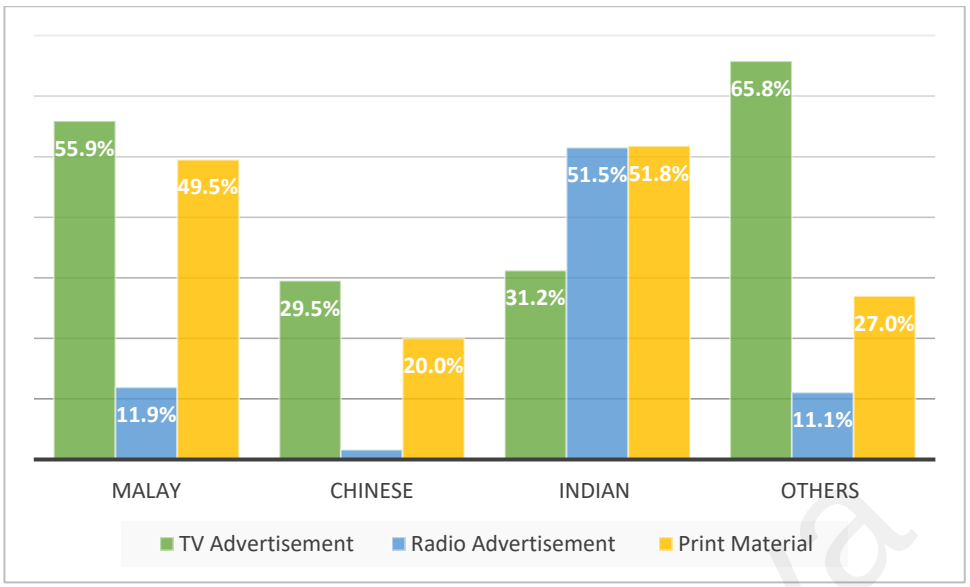

Figure 4.4: Proportion (%) of BCAC – CRC material reaches between ethnicity

All three BCAC-CRC materials were recognised by more female than male participants (Figure 4.6). The most reached advertisement was TV at 51% for females and 41.2% for males. Secondly, printed BCAC – CRC material was reached among 46.5% of females and 44.4% of males. The least-reached advertisement was radio advertisement by 23.2% of females and 19.2% of males.

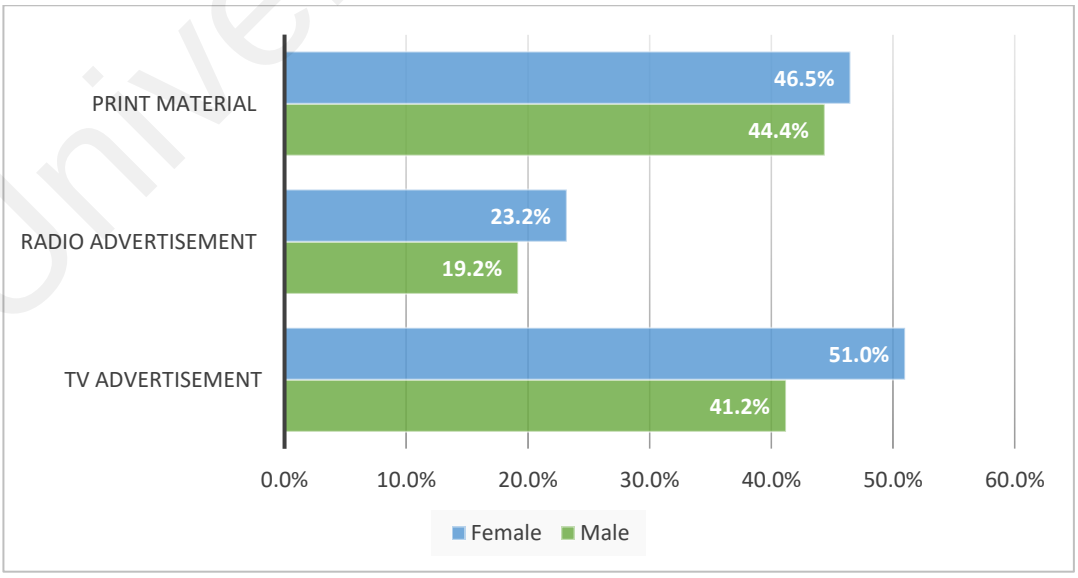

Figure 4.5: Proportion (%) of participants who recognised BCAC – CRC material by gender

4.4.3 The reach of BCAC-CRC social media and helpline among study participants

Twenty-four Facebook 'posts' regarding BCAC - CRC were developed and shared through the NCSM Facebook page during the five-week campaign period. The posts that explained CRC with visuals such as graphics were indicated as the most engaged posts by the number of likes. The post reached 51,132 people (who viewed the posts) and engaged (who liked the posts) 2,065 people. The post containing information about the symptoms of CRC also had quite a significant number of views (reach: 92,678; total engagement: 1493). The shared Malay language posts obtained the highest total engagement level, while Tamil and Chinese language posts attained minimal reach and engagement.

Six calls to the NCSM Helpline were by callers who needed advice about the CRC and mentioned that they had learned about the helpline through the BCAC-CRC materials. Four of those callers heard about BCAC-CRC through the radio advertisements, one knew about the campaign through the website, and the last one watched the Facebook advertisement.

4.4.4 The BCAC-CRC materials recognition and perception among study participants

According to Figure 4.4, 42.9% of the participants recognised the TV advertisements, 18.4% recognised the radio advertisements, and 40.0% recognised the printed materials. Almost half of the participants (47.7%) agreed that the TV advertisement is thought-provoking for the Malaysian community, followed by printed material at 28.2% and radio advertisement at 14.2%. More than half of the participants (55.8%) confirmed that the BCAC - CRC TV advertisement is relevant to the Malaysian population. Meanwhile, 33.8% agreed with the print material, and 15.9% agreed with the radio advertisement.

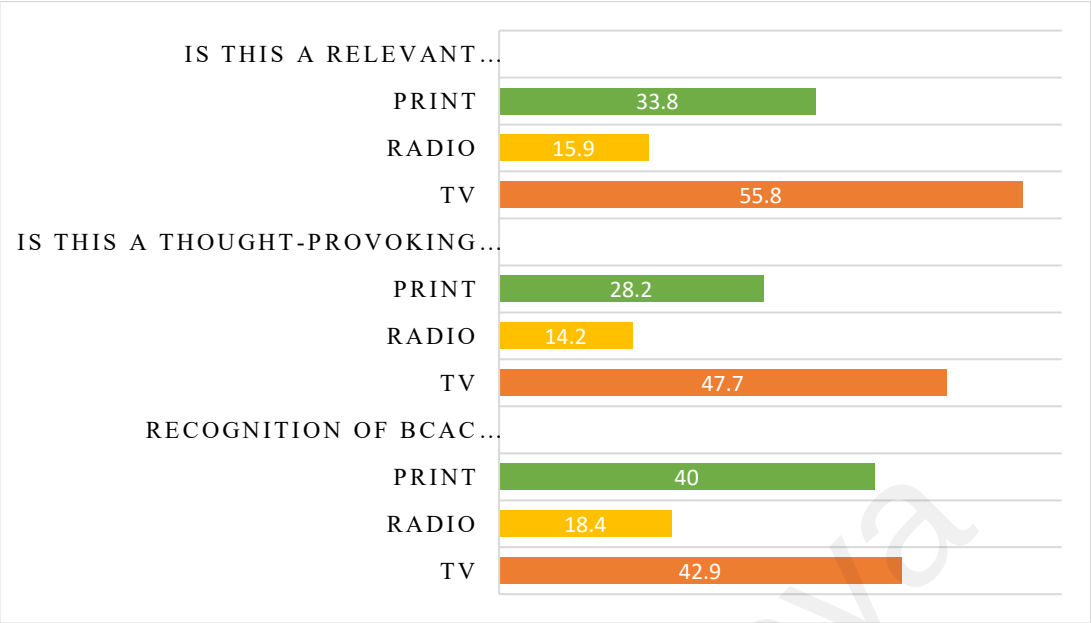

Figure 4.6: Proportion of participants who noticed the BCAC-CRC advertisements and their perception of the BCAC-CRC materials

Table 4.17 shows that the majority of participants comprising 88.6% admitted that the BCAC – CRC advertisement materials were culturally acceptable to Malaysians. About thirty-five percent of participants disclosed that they had discussed the BCAC - CRC advertisements with their friends and family. Less than 10% of participants acceded that BCAC - CRC advertisements have changed their attitudes toward colorectal cancer (9.6%) and found something new from seeing or hearing it (6.7%). Meanwhile, 19.7% of the study participants or their family or friends visited the doctor after being educated through the BCAC – CRC advertisements.

Table 4.17: The perception of participants toward the BCAC-CRC materials

Survey questions	n (%)*
Is advertising acceptable in Malaysian culture?	647 (88.6)
Did you discuss the advertising with friends or family?	255 (34.9)
Did the advertising change your attitudes toward colorectal cancer?	70 (9.6)
Did you find out anything new from seeing\hearing the advertising	49 (6.7)
Did you\your family\ friends see a doctor as a result of seeing the advertisement?	144 (19.7)

*Participants who responded "Yes" to each question.

4.4.5 Factors associated with the recognition of culturally adapted intervention for Be Cancer Alert- colorectal cancer campaign among the community from Rawang, Selangor

The participants aged 50-59 (AOR 1.12, 95% CI 1.02 – 1.24; p = 0.016) were 1.12 times more likely to recognise the campaign material compared to those aged 60 and above. This finding was statistically significant. The odds of recognising one or more of the campaign materials (TV, radio and/or print) were significantly high for Malay (AOR 1.23, 95% CI 1.23 – 1.59; p < 0.001), Indian (AOR 1.40, 95% CI 1.22 – 1.60; p < 0.001) and others (AOR 1.40, 95% CI 1.15 – 1.40; p = 0.001) compared to Chinese. In comparison with those with no formal education background participants, the odds of recognising one or more of the campaign materials were significantly higher for participants with tertiary education (adjusted OR 1.15, 95% CI 1.03 – 1.28; p= 0.013) and secondary education (adjusted OR 1.17, 95% CI 1.00 – 1.36; p= 0.016).

Table 4.18: Association between socio-demographic characteristics, colorectal cancer (CRC) history, and colorectal cancer screening history with recognition of any campaign material among respondents

Variable	BCAC-CRC Recognition		OR (95% CI)	*p-value* (GLM)	AOR (95% CI)	*p-value* (GLM)
	Yes n (%)	No n (%)				
Age						
40-49 years	161 (33.4)	66 (26.8)	1.17 (1.08, 1.28)	<0.001*	1.07 (0.97, 1.19)	0.168
50-59 years	191 (39.6)	74 (30.1)	1.19 (1.09, 1.29)	<0.001*	1.12 (1.02, 1.24)	**0.016***
60 years and above	130 (27.0)	106 (43.1)	Reference		Reference	
Gender						
Males	162 (33.5)	93 (37.8)	1.97 (1.89, 2.06)	<0.001*	0.96 (0.89, 1.05)	0.384
Females	322 (66.5)	153 (62.2)	Reference		Reference	
Ethnicity						
Malay	290 (59.9)	120 (48.8)	1.44 (1.28, 1.62)	<0.001*	1.40 (1.23, 1.59)	<0.001
Indian	140 (28.9)	65 (26.4)	1.41 (1.24, 1.59)	<0.001*	1.40 (1.22, 1.60)	<0.001
Others	29 (6.0)	13 (5.3)	1.42 (1.19, 1.69)	<0.001*	1.40 (1.15, 1.71)	**0.001***
Chinese	25 (5.2)	48 (19.5)	Reference		Reference	
Marital status						
Single	86 (17.8)	47 (19.1)	0.98 (0.90, 1.07)	0.667	0.99 (0.90, 1.10)	0.902
Married	397 (82.2)	199 (80.9)	Reference		Reference	

Table 4.18: Continued

Variable	BCAC-CRC Recognition		OR (95% CI)	*p-value* (GLM)	AOR (95% CI)	*p-value* (GLM)
	Yes n (%)	No n (%)				
Education						
Primary	100 (20.7)	43 (17.5)	1.16 (1.04, 1.32)	0.009	1.17 (1.03, 1.32)	0.054
Secondary	261 (54.1)	117 (47.6)	1.15 (1.05, 1.27)	0.003	1.15 (1.03, 1.28)	**0.013***
Tertiary	53 (11.0)	30 (12.2)	1.09 (0.96, 1.25)	0.176	1.17 (1.00, 1.36)	**0.016***
No formal education	68 (14.1)	56 (22.8)	Reference		Reference	
Household income						
<RM 4,000	357 (84.2)	155 (80.3)	1.15 (0.93, 1.43)	0.202	1.20 (0.95, 1.50)	0.123
RM 4,000-10,000	57 (13.4)	30 (15.5)	1.11 (0.87, 1.40)	0.406	1.14 (0.90, 1.44)	0.285
>RM 10,000	10 (2.4)	8 (4.1)	Reference		Reference	
CRC History						
No	394 (82.8)	192 (79.7)	1.05 (0.96, 1.15)	0.309	1.08 (0.98, 1.19)	0.104
Yes	82 (17.2)	49 (20.3)	Reference		Reference	
CRC Screening History						
No	425 (88.4)	212 (87.6)	1.02 (0.91, 1.13)	0.767	0.94 (0.84, 1.05)	0.288
Yes	56 (11.6)	30 (12.4)	Reference		Reference	

*Significant set at p <0.05

4.5 Study Objective 4: To evaluate the effectiveness of the Be Cancer Alert - colorectal cancer campaign on awareness raising (knowledge, attitude, and beliefs) about colorectal cancer and screening (belief and experience) among the community in Rawang, Selangor.

4.5.1 Characteristic of participants in pre and post household survey

The socio-demographic characteristics of the total study participants are presented in Table 4.19. At baseline, 954 participants from 710 households completed the CRC survey, and 730 participants (76.5%) from 559 households agreed to complete the follow-up survey (Table 4.9). The largest number of participants who completed baseline and follow-up surveys were females (65.1%). The mean age was 55 for both pre and post-campaign, with 36.3% of participants aged between 50 and 59. About one-third of participants were aged between 40 to 49 years (31.1%) and 50 to 59 years (36.4%). The majority of participants at follow-up were Malay (56.2%), followed by Indian (28.1%), Chinese (10.0%), and others (5.8%). More than half of the study population had received secondary education (51.9%) or tertiary education (11.4%). The 'Others' mainly consisted of participants from Indonesia and the Philippines. The latest government income grouping (Ng et al., 2018) reported that 83% of participants had low-income households, meaning their family income was lower than RM 4000 monthly. About 70% of the participants had a monthly family income below RM 4000. Compared to the baseline survey, fewer males, Chinese, and tertiary-educated participants completed the follow-up survey. There were few differences between participants who completed the follow-up and those who didn't.

Table 4.19: Sociodemographic characteristics of participants pre- and post-campaign household survey

Variable	Pre (n=954)	Post (n=730)
	Mean (SD)	**Mean (SD)**
Age	54.97 (9.67)	55.33 (9.57)
40 – 49	314 (32.9)	227 (28.2)
50 – 59	346 (36.3)	265 (36.3)
60 and above	292 (30.6)	236(32.4)
Missing value	2 (2.0)	2 (0.3)
	n (%)	**n (%)**
Gender		
Male	361 (37.8)	255 (34.9)
Female	593 (62.2)	475 (65.1)
Nationality		
Malaysian	871 (91.3)	670 (91.8)
Non-Malaysian	80 (8.4)	58 (7.9)
Ethnicity		
Malay	516 (54.1)	410 (56.2)
Chinese	110 (11.5)	73 (10.0)
Indian	264 (27.7)	205 (28.1)
Others	64 (6.7)	42 (5.8)
Religion		
Islam	585 (61.3)	460 (63.0)
Buddhism	95 (10.0)	25 (3.4)
Hinduism	226 (23.7)	62 (8.5)
Christianity	35 (3.7)	175 (24.0)
Sikhism	6 (0.6)	4 (0.5)
Others	5 (0.5)	3 (0.4)
Marital Status[a]		
Single	31 (3.2)	24 (3.3)
Married	783 (82.1)	596 (81.6)
Divorcee	24 (2.5)	21 (2.9)
Widow	112 (11.7)	88 (12.1)

Table 4.19: Continued

Variable	Pre (n=954)	Post (n=730)
	n (%)	n (%)
Educational level[b]		
No formal education	152 (16.0)	124 (17.0)
Primary education	190 (20.0)	143 (19.6)
Secondary education	485 (51.0)	378 (51.8)
Tertiary education	124 (13.0)	83 (11.4)
Missing value	3 (0.3)	2 (0.3)
Monthly family income[c]		
Below RM 4000	661 (69.3)	512 (70.1)
RM 4001- RM 10,000	117 (12.3)	87 (11.9)
RM 10,001 and above	30 (3.1)	18 (2.5)
Missing value	146 (15.3)	113 (15.5)
CRC History[d]		
No	623 (85.3)	586 (80.3)
Yes	98 (13.4)	131 (17.9)
CRC Screening History (in the past five years)		
No	660 (90.4)	637 (87.3)
Yes	70 (9.6)	86 (11.8)

n- number, RM –Ringgit Malaysia,
[a] Participants who are widowed, divorced and never married
[b] No formal education – includes never schooled/ never completed primary school; primary education – includes completed primary school; secondary education – includes completed form 3/ completed form 5/ certificate/ A-level/ STPM/ HSC; tertiary education – includes diploma/ bachelor degree/ post-graduate degree
[c] Monthly income of all household family members combined
[d] CRC history includes self/ family/ friends; those who answered 'yes' to CRC history and CRC screening were reported as CRC history only

4.5.2 Changes in knowledge (symptoms and risk factors) of colorectal cancer (CRC) among study participants after the campaign

4.5.2.1 CRC Symptoms (pre and post-campaign)

During the household survey, information was gathered from participants through two different approaches. Firstly, participants were asked to complete the questionnaire without the provision of any options for selection. This was an unprompted approach purely based on the recall of participants. Secondly, participants were asked to complete

the questionnaire with a provision of options for selection. This was the prompted approach.

Unprompted awareness of CRC symptoms

During the household survey (pre and post-campaign), participants were asked to list as many symptoms of CRC as they could recall (unprompted). Table 4.20 shows that recall of all the unprompted symptoms of colorectal cancer increased slightly post-campaign except for 'bleeding from the back passage,' which decreased from 3.6% (pre-campaign) to 1.9% (post-campaign). Recall of 'blood in stool' increased significantly during post-campaign (4.5% and 19.5%, $p < 0.001$), followed by 'unexplained weight loss' (1.4% and 4.5%, $p < 0.001$) and 'feeling that your colorectal does not completely empty after using the lavatory' (4.1% and 6.6%, $p < 0.001$).

Prompted awareness of CRC symptoms

In the second approach, participants were prompted through the questionnaire and selected symptoms of colorectal cancer from the options given. During the post-campaign, more than 50% of participants correctly identified all symptoms of colorectal cancer (Table 4.20). The three most commonly identified symptoms for pre and post-campaign were 'blood in stool' (54.0% and 67.4%, $p < 0.001$) followed by 'bleeding from the back passage' (46.4% and 61.1%; $p < 0.001$) and 'persistent pain in abdomen tummy' (51.0% and 60.4%; $p < 0.001$). Overall, the level of awareness increased significantly for all the prompted symptoms of colorectal cancer.

Table 4.20: Proportions of CRC symptom recognition (Pre-and Post-campaign) (n = 730)

Survey question	Pre n (%)	Post n (%)	*P-value (McNemar)*
There are many warning signs and symptoms of colorectal cancer. Please name as many as you can think of:			
Bleeding from back passage	26 (3.6)	14 (1.9)	0.074
Persistent abdominal pain	165 (22.6)	186 (25.5)	0.150
Change in bowel habits	69 (9.5)	88 (12.1)	0.102
Feeling that bowel does not empty after using lavatory	30 (4.1)	48 (6.6)	0.034*
Blood in stool	33 (4.5)	142 (19.5)	< 0.001*
Pain in back passage	1 (0.1)	6 (0.8)	0.125
Lump in your abdomen	3 (0.4)	9 (1.2)	0.146
Tiredness/ anaemia	16 (2.2)	25 (3.4)	0.176
Unexplained weight loss	10 (1.4)	33 (4.5)	<0.001*
Symptoms (prompted)			
Bleeding from back passage	339 (46.4)	446 (61.1)	< 0.001*
Persistent abdominal pain	372 (51.0)	441 (60.4)	< 0.001*
Change in bowel habits	335 (45.9)	403 (55.2)	< 0.001*
Feeling that bowel does not empty after using lavatory	330 (45.2)	396 (54.2)	< 0.001*
Blood in stool	394 (54.0)	492 (67.4)	< 0.001*
Pain in back passage	256 (35.1)	384 (52.6)	< 0.001*
Lump in your abdomen	358 (49.0)	410 (56.2)	0.003*
Tiredness/ anaemia	283 (38.8)	379 (51.9)	< 0.001*
Unexplained weight loss	378 (51.8)	415 (56.8)	0.031*

*Significant set at p <0.05

4.5.2.2 CRC Risk Factors (pre and post-campaign)

Unprompted awareness of CRC risk factors

During the survey, participants were asked to recall as many risk factors of colorectal cancer. Two common risk factors recognised by participants are 'eating red or processed

meat once a day or more' and 'eating less than five portions of fruit and vegetables a day,' which also significantly increased after the campaign. Respectively, 'eating red or processed meat once a day or more' (1.2% vs 3.7%; p=0.004) and 'eating less than five portions of fruit and vegetables a day' (0.4% vs 2.1%; p=0.008). Meanwhile, 'drinking more than 1 unit of alcohol a day' was identified as a risk factor which significantly decreased after the campaign (7.7% vs 5.1%; p=0.042).

Prompted awareness of CRC risk factors

Participants were asked to identify the risk factors of colorectal cancer according to the list provided during the survey. More than 50% of participants correctly identified all the CRC risk factors during the post-campaign survey compared to the pre-campaign survey except for 'having diabetes' and 'being overweight or obese'. Although 'having diabetes' is only identified by less than 50% of participants, this finding significantly increased after the post-campaign (32.6% vs 38.6%; p= 0.011). Overall, there was an increase from pre-campaign to post-campaign on all prompted risk factors that can increase the chance of getting CRC. Table 4.21 shows there is a significant increase in the level of awareness of all the prompted risk factors of colorectal cancer except 'eating red or processed meat once a day or more' (68.5% vs 71.1%; p = 0.222), 'having a diet low in fibre (57.3% vs 61.5%; p = 0.086) and 'being overweight or obese' (42.5% vs 44.2%; p = 0.225). However, 'being over 70 years old' (39.9% vs 52.7%; p < 0.001) and 'having a close relative with colorectal cancer' (38.6% vs 49.9%; p < 0.001) were the risk factors that correctly identified and shown significantly increase from pre to post campaign (Table 4.21).

Table 4.21: Proportions of CRC risk factor recognition (Pre-and Post-campaign) (n = 730)

Survey question	Pre n (%)	Post n (%)	*p-value (McNemar)*
What things do you think affect a person's chance of developing colorectal cancer?			
Drinking more than 1 unit of alcohol a day	56 (7.7)	37 (5.1)	0.042*
Eating less than 5 portions of fruit and vegetables a day	3 (0.4)	15 (2.1)	0.008*
Eating red or processed meat once a day or more	9 (1.2)	27 (3.7)	0.004*
Having a diet low in fibre	2 (0.3)	3 (0.4)	1.000
Being overweight or obese	2 (0.3)	2 (0.3)	1.000
Being over 70 years old	3 (0.4)	2 (0.3)	1.000
Having a close relative with colorectal cancer	44 (6.0)	34 (4.7)	0.275
Doing less than 30 mins of moderate physical activity 5 times a week	17 (2.3)	15 (2.1)	0.856
Having a colorectal disease	8 (1.1)	2 (0.3)	0.109
Having diabetes	1 (0.1)	0 (0.0)	-
Risk Factors (prompted)			
Drinking more than 1 unit of alcohol a day	466 (63.8)	510 (69.9)	0.008
Eating less than 5 portions of fruit and vegetables a day	424 (58.1)	470 (64.4)	0.007*
Eating red or processed meat once a day or more	500 (68.5)	519 (71.1)	0.222
Having a diet low in fibre	418 (57.3)	449 (61.5)	0.086
Being overweight or obese	310 (42.5)	332 (45.5)	0.225
Being over 70 years old	291 (39.9)	385 (52.7)	< 0.001*
Having a close relative with colorectal cancer	282 (38.6)	364 (49.9)	< 0.001*
Doing less than 30 mins of moderate physical activity 5 times a week	338 (46.3)	373 (51.1)	0.042*
Having a colorectal disease	480 (65.8)	528 (72.3)	0.003*
Having diabetes	238 (32.6)	282 (38.6)	0.011*

*Significant set at p <0.05

4.5.2.3 Improved Knowledge of CRC (symptoms or risk factors)

A participant is considered to have some knowledge of CRC if they were able to recognise either any of the CRC symptoms or risk factors. A participant is deemed to have an improved knowledge of CRC if the total number of recognised symptoms or risk factors in the post-campaign is greater than pre-campaign.

After the campaign, 202 (27.2%) and 374 (51.2%) participants showed improved knowledge in recognising CRC symptoms and risk factors, respectively (Table 4.20). A total number of 498 (68.2%) participants showed an improvement in identifying either symptoms or risk factors of CRC after the campaign. The Wilcoxon's signed-rank test (W=8.204, p<0.001) showed that the campaign had significantly improved knowledge scores after the campaign (median=7, IQR 12.00, 15.00) compared to before the campaign (median=6, IQR 9.00, 13.00).

Table 4.22: Proportions of improved knowledge in CRC

Improved knowledge of CRC	**n (%)**
Symptoms	202 (27.2)
Risk Factors	374 (51.2)
Symptoms or Risk Factors	498 (68.2)
Median score of knowledge in CRC	**Median (Q1, Q3)**
Pre-campaign	6 (9.00, 13.00)
Post-campaign	7 (12.00, 15.00)
Wilcoxon's signed-rank test	W=-8.204, p<0.001

4.5.2.4 Factors associated with post-campaign knowledge score (symptoms and risk factor) in CRC using bivariate analysis

Post-campaign knowledge scores were significantly different by ethnicity, H(3) = 42.086, p<0.001. Pairwise comparison showed that the post-campaign knowledge score was significantly higher (p<0.001) for Malay (median= 13, IQR 9.00, 16.00) and Indian (median= 11, IQR 6.00, 15.00) compared to Chinese (median= 8, IQR 4.00, 12.00). Post-campaign knowledge scores were significantly different by education background, H(3)

= 36.476, p<0.001. Pairwise comparison showed that the post-campaign knowledge score was significantly higher (p<0.001) for tertiary education (median= 12, IQR 9.00, 15.00) and secondary (median= 13, IQR 9.00, 16.00) compared to no formal education background (median= 10, IQR 4.25, 13.00). For education background, the pairwise comparison showed that the post-campaign knowledge score was significantly higher (p<0.001) for tertiary education (median= 12, IQR 9.00, 15.00) and secondary education (median= 13, IQR 9.00, 16.00) compared to primary education background (median= 9, IQR 6.00, 13.00). Post-campaign knowledge scores were significantly different by monthly household income, H (2) = 9.044, p=0.011. Pairwise comparison showed that the post-campaign knowledge score was significantly higher (p<0.001) for monthly household income of RM 4,000 – RM10, 000 (median= 14, IQR 10.00, 16.00) compared to monthly household income of less than RM 4,000 (median= 11, IQR 7.00, 15.00). The post-campaign knowledge score was significantly higher among those who had friends and family with a history of CRC compared with those without. A Mann-Whitney test showed that the post-campaign knowledge score among those who had friends and family with a history of CRC (median= 13, IQR 10.00, 16.00) is significantly higher than those without (median= 11, IQR 7.00, 15.00, U=45,318.500, p<0.001). The Mann-Whitney test showed that the post-campaign knowledge score among those who recognise BCAC-CRC (median= 13, IQR 9.00, 16.00) is significantly higher than those who didn't recognise BCAC-CRC (median= 9, IQR 5.00, 13.00, U=79,251.500, p<0.001).

Table 4.23: Factors associated with post-campaign knowledge score using bivariate analysis

Variable	Post Knowledge Score Median (IQR)	z/t value	p-value
Age			
40-49 years	12 (9.00, 15.00)	Kruskal Wallis H (5.597)	0.061
50-59 years	12 (7.00, 15.00)		
60 years and above	12 (6.25, 15.00)		
Gender			
Males	11 (7.00, 15.00)	Mann-Whitney (62,781.000)	0.431
Females	12 (7.00, 15.00)		
Ethnicity			
Malay	13 (9.00, 16.00)	Kruskal Wallis H (42.086)	<0.001*
Chinese	8 (4.00, 12.00)		
Indian	11 (6.00, 15.00)		
Others	11 (6.00, 14.00)		
Marital status			
Single	12 (6.00, 16.00)	Mann-Whitney (42,426.000)	0.718
Married	12 (7.00, 15.00)		
Education			
No formal education	10 (4.25, 13.00)	Kruskal Wallis H (36.476)	<0.001*
Primary	9 (6.00, 13.00)		
Secondary	12 (9.00, 15.00)		
Tertiary	13 (9.00, 16.00)		
Household income			
<RM 4,000	11 (7.00, 15.00)	Kruskal Wallis H (9.044)	0.011*
RM 4,000-10,000	14 (10.00, 16.00)		
>RM 10,000	13 (9.75, 15.00)		

Table 4.23: Continued

Variable	Post Knowledge Score Median (IQR)	z/t value	p-value
CRC History			
No	11 (7.00, 15.00)	Mann-Whitney (45,318.500)	0.001*
Yes	13 (10.00, 16.00)		
CRC Screening History			
No	12 (7.00, 15.00)	Mann-Whitney (58,546.500)	0.126
Yes	12 (9.00, 15.00)		
BCAC-CRC recognition			
No	9 (5.00, 13.00)	Mann-Whitney (79,251.500)	<0.001*
Yes	13 (9.00, 16.00)		

*Significant set at p <0.05

4.5.2.5 Factors associated to improved knowledge in CRC after campaign using GEE analysis

Significant determinants on the improvement in knowledge about colorectal cancer were post-campaign (β= 1.811, CI= 1.409, 2.213), Chinese (β = -2.740, CI= -3.794, -1.687), tertiary education (β=2.914, CI=1.699, 4.129), secondary education (β=1.889, CI=1.009, 2.769), those who had friends and family with history of CRC (β=1.149, CI=0.379, 1.919), and BCAC-CRC recognition (β=1.494, CI=0.860, 2.129). Results from the post-campaign (β= 1.811, CI= 1.409, 2.213) showed a significant improvement in knowledge about CRC symptoms and risk factors by 1.811 units. In comparison to participants with no formal education, the improvement in knowledge among participants from tertiary education (β= 2.914, CI= 1.699, 4.129) and secondary education (β=1.889, CI= 1.009, 2.769) was significantly higher by 2.914 units and 4.129 units respectively. Even after the campaign, Chinese participants (β = -2.740, CI= -3.794, -1.687) seemed to

have a lower improvement in knowledge compared to Malay participants by 2.740 units. This finding is perhaps explained by the lower frequency of campaign reach especially among the Chinese. Participants who have family and friends with a history of CRC (β =1.149, CI=0.379, 1.919) seem to have 1.149 units higher improvement in knowledge compared to participants who have family and friends without a history of CRC. In comparison to participants who did not recognise the BCAC-CRC material, the knowledge among participants who recognised the BCAC-CRC material improved significantly by 1.494 units (β=1.494, CI=0.860, 2.129).

Table 4.24: Factors associated with improved knowledge score of CRC (symptoms and risk factors) after campaign using GEE Analysis (n = 730)

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Intercept	7.211	.7630	5.715	8.706	**<0.001***
Overall Pre-Post					
Post-campaign	1.811	.2053	1.409	2.213	**<0.001***
Pre-campaign	0[a]	-	-	-	-
Age					
60 and above	-.132	.3944	-.905	.641	0.738
50-59	-.431	.3609	-1.138	.277	0.233
40-49	0[a]	-	-	-	-
Gender					
Female	.306	.3511	-.382	.994	0.384
Male	0[a]	-	-	-	-
Ethnicity					
Others	-.675	.6433	-1.936	.586	0.294
Indian	-.568	.3478	-1.249	.114	0.103
Chinese	-2.740	.5375	-3.794	-1.687	**<0.001***
Malay	0[a]	-	-	-	-
Marital Status					
Single	-.163	.4277	-1.001	.675	0.703
Married	0[a]	-	-	-	-

Table 4.24: Continued

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Education					
Tertiary	2.914	.6199	1.699	4.129	**<0.001***
Secondary	1.889	.4489	1.009	2.769	**<0.001***
Primary	-.224	.4997	-1.204	.755	0.654
No formal education	0	-	-	-	-
Household income					
> RM 10,000 (high)	-.116	.8954	-1.871	1.639	0.897
RM 4,000 - RM 10,000 (middle)	.758	.4338	-.092	1.608	0.080
< RM 4,000 (low)	0[a]	-	-	-	
CRC History					
Yes	1.149	.3928	.379	1.919	**0.003***
No	0[a]	-	-	-	-
CRC Screening History					
Yes	.920	.4714	-.004	1.844	0.051
No	0[a]	-	-	-	-
BCAC-CRC recognition					
Yes	1.494	.3237	.860	2.129	**<0.001***
No	0[a]	-	-	-	-

* Generalised estimating equations analysis based on saturated model
* p-value < 0.05 are in bold
* [a] = Reference category

4.5.2.6 Factors associated to improved knowledge in CRC among campaign recognisers after campaign using GEE analysis

Significant determinants on the improvement in knowledge about colorectal cancer among campaign recognisers were Malay (β= 2.594, CI= 0.850, 4.339), Indian (β= 1.906, CI= 0.126, 3.686), others (β= 2.686, CI= 0.479, 4.892), secondary education (β= 2.016, CI= 1.036, 2.995), tertiary education (β= 2.517, CI= 1.177, 3.858) and post-campaign (β= 2.290, CI= 1.806, 2.773). Results from the post-campaign (β= 2.290, CI= 1.806, 2.773) showed a significant improvement in knowledge about CRC symptoms and risk factors

among campaign recognisers by 2.290 units. After the campaign, Malay (β= 2.594, CI= 0.850, 4.339), Indian (β= 1.906, CI= 0.126, 3.686) and others (β= 2.686, CI= 0.479, 4.892) showed a significant improvement in knowledge compared to Chinese participants by 2.594 units, 1.906 units and 2.686 units respectively. In comparison to participants with primary education, the improvement in knowledge among participants from tertiary education (β= 2.517, CI= 1.177, 3.858) and secondary education (β= 2.016, CI= 1.036, 2.995) was significantly higher by 2.517 units and 2.016 units respectively. Participants who have a history of CRC screening (β =1.187, CI=0.052, 2.322) seem to have 1.187 units higher improvement in knowledge compared to participants who don't have a history of CRC screening.

Table 4.25: Factors associated with improved knowledge score of CRC among campaign recognisers (symptoms and risk factors) using GEE Analysis (n = 411)

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Intercept	4.487	1.4251	1.693	7.280	**0.002***
Overall Pre-Post					
Post-campaign	2.290	.2469	1.806	2.773	**<0.001***
Pre-campaign	0[a]	-	-	-	-
Age					
40-49	.437	.4359	-.417	1.291	0.316
60 and above	.491	.4636	-.418	1.399	0.290
50-59	0[a]	-	-	-	-
Gender					
Female	.233	.4209	-.592	1.058	0.580
Male	0[a]	-	-	-	-
Ethnicity					
Others	2.686	1.1258	.479	4.892	**0.017***
Indian	1.906	.9083	.126	3.686	**0.036***
Malay	2.594	.8900	.850	4.339	**0.004***
Chinese	0[a]	-	-	-	-

Table 4.25: Continued

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Marital Status					
Single	.316	.5108	-.685	1.317	0.536
Married	0[a]	-	-	-	-
Education					
Tertiary	2.517	.6841	1.177	3.858	**<0.001***
Secondary	2.016	.4996	1.036	2.995	**<0.001***
No formal education	.715	.6121	-.485	1.914	0.243
Primary	0	-	-	-	-
Household income					
< RM 4,000 (low)	.661	.9587	-1.218	2.540	0.490
RM 4,000 - RM 10,000 (middle)	1.584	.9984	-.373	3.541	0.113
> RM 10,000 (high)	0[a]	-	-	-	
CRC History					
Yes	.404	.5181	-.611	1.419	0.436
No	0[a]	-	-	-	-
CRC Screening History					
Yes	1.187	.5790	.052	2.322	**0.040***
No	0[a]	-	-	-	-

* Generalised estimating equations analysis based on saturated model
* p-value < 0.05 are in bold
* [a] = Reference category (Reference category for each independent variable is changed to produce optimal estimates in the outcome)

4.5.3 Reduction in negative beliefs of cancer and colorectal cancer screening among study participants after the BCAC-CRC

4.5.3.1 Negative and Positive Beliefs in Cancer (pre and post-campaign)

Table 4.26 highlights the positive changes in participants' beliefs in pre and post-campaign. There is a significant positive change in the three negative statements and one positive statement about CRC's beliefs that were prompted during the household survey among participants. In addition, it demonstrates a non-significant positive change in the other two positive statements about CRC beliefs after the BCAC-CRC campaign.

Respectively, the positive statements such as 'going to the doctor as quickly as possible after noticing a symptom of cancer could increase the chances of surviving' (40.0% vs 39.0%; p 1.000) and 'these days many people with cancer can expect to continue with normal activities and responsibilities' 23.6% vs 22.2% p 0.266).

Table 4.26: Proportions of negative and positive beliefs in cancer (Pre-and Post-campaign) (n = 730)

Survey question	Pre n (%)	Post n (%)	*p-value (McNemar)*
Negative Belief (Agreed to statement)			
Some people think that a diagnosis of cancer is a death sentence.	327 (44.8)	247 (33.8)	< 0.001*
Most cancer treatment is worse than cancer itself.	434 (59.5)	371 (50.8)	< 0.001*
I would NOT want to know if I have cancer.	292 (40.0)	163 (22.3)	< 0.001*
Positive Belief (Disagreed to statement)			
Cancer can often be cured.	135 (18.5)	100 (13.7)	0.004*
Going to the doctor as quickly as possible after noticing a cancer symptom could increase survival chances.	40 (5.5)	39 (5.3)	1.000
These days, many people with cancer can expect to continue with normal activities and responsibilities.	172 (23.6)	162 (22.2)	0.266

*Significant set at p <0.05

4.5.3.2 Negative and positive beliefs in colorectal cancer screening (pre and post-campaign)

Table 4.27 highlights the positive change in belief towards CRC screening before and after the BCAC-CRC campaign. A significant change in participants who agreed with 'colorectal cancer screening is only necessary if I have symptoms' (43.4% vs 47.8%; p 0.048) after the BCAC-CRC campaign. The participants who agreed to 'I would be so worried about what might be found at a colorectal cancer screening, that I would prefer not to do it' (62.5% vs 59.3%; p 0.367) and participants who disagreed with 'colorectal cancer screening could reduce my chances of dying from colorectal cancer' (78.8% to 81.0%; p=0.403) showed a slightly higher positive change in the post-household survey. However, those differences in the beliefs towards CRC screening were not significant.

Table 4.27: Proportions of negative and positive beliefs in colorectal cancer screening (Pre-and Post-campaign) (n = 730)

Survey question	Pre n (%)	Post n (%)	*p-value (McNemar)*
I would be so worried about what might be found at a colorectal cancer screening that I would prefer not to do it.	456 (62.5)	433 (59.3)	0.367
Colorectal cancer screening is only necessary if I have symptoms.	317 (43.4)	349 (47.8)	0.048*
Colorectal cancer screening could reduce my chances of dying from colorectal cancer.	102 (14.0)	91 (12.5)	0.403

*Positive change: Negative belief - Participants agreed with the statement in the pre-campaign but disagreed in the post-campaign
Positive belief - Participants disagreed with the statement in the pre-campaign but agreed in the post-campaign

*Significant set at p <0.05

4.5.3.3 Reduction of negative beliefs in cancer or colorectal cancer (CRC) screening

During the campaign, participants were asked to agree or disagree with negative and positive belief statements about cancer and CRC screening. Those who agreed with negative belief statements before the campaign but changed their minds and disagreed after the campaign were considered to have reduced negative beliefs. Similarly, those who disagreed with positive belief statements before the campaign but changed their minds and agreed after the campaign were also considered to have reduced negative beliefs.

After the campaign, 584 participants (80.0%) showed a reduction in negative beliefs about cancer screening, and 292 participants (40.0%) showed a reduction in negative beliefs about CRC screening. Additionally, a total of 532 participants (72.9%) showed a reduction in either cancer or CRC screening negative beliefs.

The Wilcoxon's signed-rank test (W=-6.244, p<0.001) showed that the campaign significantly reduced negative beliefs. The median negative belief score decreased from 4 (with an interquartile range (IQR) of 3.00 to 5.00) before the campaign to 3 (with an IQR of 4.00 to 2.00) after the campaign.

Table 4.28: Proportions of reduction in negative beliefs

Reduction of negative beliefs	**n (%)**
Belief about cancer	584 (80.0)
Belief about colorectal cancer screening	292 (40.0)
Belief about cancer or Belief about colorectal cancer screening	532 (72.9)
Median Score of Negative beliefs	**Median (Q1, Q3)**
Pre-campaign	4 (3.00, 5.00)
Post-campaign	3 (4.00, 2.00)
Wilcoxon's signed-rank test	W=-6.244, p<0.001

4.5.3.4 Factors associated with negative beliefs in cancer and colorectal cancer screening after campaign using bivariate analysis

Post-campaign belief score was significantly different by age, H (2) = 6.594, p=0.037. Pairwise comparison showed that the post-campaign belief score was significantly higher (p=0.037) for participants aged 60 years and above (median= 3, IQR 2.00, 4.00) compared to participants aged 40-49 years (median= 2, IQR 1.00, 3.00). Results of post-campaign belief score were significantly different by ethnicity, H (3) = 24.986, p<0.001. Pairwise comparison showed that the post-campaign belief score was significantly higher (p<0.001) for Chinese (median= 3, IQR 3.00, 5.00) compared to Malay (median= 2, IQR 1.00, 3.00) and Indian (median= 2, IQR 1.00, 4.00). A Mann-Whitney test showed that the post-campaign belief score among single participants (median= 3, IQR 2.00, 4.00) is significantly higher than that of married participants (median= 2, IQR 1.00, 4.00, U=16, 681.500, p=0.009). In addition, the post-campaign belief score was significantly different by monthly household income, H (2) = 7.383, p=0.025. Pairwise comparison showed that post-campaign belief score was significantly higher (p=0.025) for monthly household income of less than RM 4,000 (median= 2, IQR 1.00, 4.00) compared to monthly household income of more than RM 10,000 (median= 2, IQR 0.25, 2.00). Another Mann-Whitney test showed that the post-campaign belief score among those who didn't recognise BCAC-CRC (median= 3, IQR 2.00, 4.00) is significantly higher than those who recognise BCAC-CRC (median= 2, IQR 1.00, 3.00, U=24,337.000, p=0.004).

Table 4.29: Factors associated with negative beliefs in cancer and colorectal cancer screening after campaign using bivariate analysis

Variable	Post Belief Score Median (Q1,Q3)	z/t value	p-value
Age			
40-49 years	3.00 (2.00, 4.00)	Kruskal Wallis H (6.594)	0.037*
50-59 years	3.00 (2.00, 4.00)		
60 years and above	3.00 (2.00, 4.00)		
Gender			
Males	3.00 (2.00, 4.00)	Mann-Whitney (30,659.500)	0.504
Females	3.00 (2.00, 4.00)		
Ethnicity			
Malay	3.00 (2.00, 4.00)	Kruskal Wallis H (24.986)	<0.001*
Chinese	4.00 (3.00, 5.00)		
Indian	3.00 (2.00, 4.00)		
Others	3.00 (2.00, 4.00)		
Marital status			
Single	3.00 (2.00, 4.00)	Mann-Whitney (16, 681.500)	0.009*
Married	3.00 (2.00, 4.00)		
Education			
No formal education	3.00 (2.00, 4.00)	Kruskal Wallis H (4.367)	0.224
Primary	3.50 (2.00, 4.00)		
Secondary	3.00 (2.00, 4.00)		
Tertiary	3.00 (2.00, 4.00)		

Table 29: Continued

Variable	Post Belief Score Median (Q1,Q3)	z/t value	p-value
Household income			
<RM 4,000	3.00 (2.00, 4.00)	Kruskal Wallis H (7.383)	0.025*
RM 4,000-10,000	3.00 (2.00, 4.00)		
>RM 10,000	2.00 (1.00, 3.25)		
CRC History			
No	3.00 (2.00, 4.00)	Mann-Whitney (22,963.500)	0.525
Yes	3.00 (2.00, 4.00)		
CRC Screening History			
No	3.00 (2.00, 4.00)	Mann-Whitney (16,732.500)	0.268
Yes	3.00 (2.00, 4.00)		
BCAC-CRC recognition			
No	3.00 (2.00, 4.00)	Mann-Whitney (24,337.000)	0.004*
Yes	3.00 (2.00, 4.00)		

*Significant set at p <0.05

4.5.3.5 Factors associated with a reduction of negative beliefs in cancer and colorectal cancer screening after campaign using GEE analysis

Significant determinants of the reduction in negative beliefs were post-campaign (β= -0.642, CI= -0.450, -0.833), participants aged 50-59 (β= 0.280, CI= 0.019, 0.540), Indian (β= 0.302, CI= 0.039, 0.566), Chinese (β = 0.884, CI= 0.506, 1.262), single (β = -0.390, CI= -0.705, -0.076), participant's household income more than RM 10, 000 (β = -0.650, CI= -1.175, -0.124), and BCAC-CRC recognition (β=-0.429, CI=-0.684, -0.174). Results from the post-campaign (β= -0.642, CI= 0.450, 0.833) showed a significant reduction in negative beliefs by -0.642 units. In comparison to Malay participants, Indians (β= 0.302, CI= 0.039, 0.566) and Chinese (β = 0.884, CI= 0.506, 1.262) were more likely to have an

increase in negative beliefs by 0.302 units and 0.884 units respectively. Those older participants aged 50-59 (β= 0.280, CI= 0.019, 0.540) and aged 60 and above (β= 0.082, CI= -0.230, 0.395) were more likely to have an increase in negative beliefs by 0.280 units and 0.082 units respectively. Participants' household incomes of more than RM 10, 000 (β = -0.650, CI= -1.175, -0.124) showed a significant reduction in negative beliefs compared to household incomes of less than RM 4, 000. In comparison to participants who did not recognise the BCAC-CRC material, the negative beliefs among participants who recognised the BCAC-CRC material reduced significantly by -0.429 units (β=-0.429, CI=-0.684, -0.174).

Table 4.30: Factors associated with a reduction of negative beliefs about cancer and colorectal cancer screening after BCAC-CRC using GEE analysis (n = 730)

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Intercept	3.753	.3291	3.108	4.398	**<0.001***
Overall Pre-Post					
Post-campaign	-.642	.0975	-0.833	-.450	**<0.001***
Pre-campaign	0[a]	-	-	-	-
Age					
60 and above	.082	.1595	-.230	.395	0.606
50-59	.280	.1328	.019	.540	**0.035***
40-49	0[a]	-	-	-	-
Gender					
Female	-.209	.1301	-.464	.046	0.108
Male	0[a]	-	-	-	-
Ethnicity					
Others	.215	.2478	-.270	.701	0.385
Indian	.302	.1345	.039	.566	**0.024***
Chinese	.884	.1928	.506	1.262	**<0.001***
Malay	0[a]	-	-	-	-

Table 4.30: Continued

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Marital Status					
Single	-.390	.1604	-.705	-.076	**0.015***
Married	0[a]	-	-	-	-
Education					
Tertiary	-.014	.2375	-.480	.451	0.953
Secondary	-.098	.1802	-.451	.256	0.588
Primary	.251	.2044	-.149	.652	0.219
No formal education	0	-	-	-	-
Household income					
> RM 10,000 (high)	-.650	.2679	-1.175	-.124	**0.015***
RM 4,000 - RM 10,000 (middle)	-.211	.1505	-.506	.084	0.161
< RM 4,000 (low)	0[a]	-	-	-	
CRC History					
Yes	.071	.1474	-.218	.360	0.632
No	0[a]	-	-	-	-
CRC Screening History					
Yes	-.134	.1752	-.478	.209	0.444
No	0[a]	-	-	-	-
BCAC-CRC recognition					
Yes	-.429	.1301	-.684	-.174	**0.001***
No	0[a]	-	-	-	-

* Generalized estimating equations analysis based on saturated model
* p-value < 0.05 are in bold
* a = Reference category

4.5.3.6 Factors associated with a reduction of negative beliefs in cancer and colorectal cancer screening among campaign recognisers after campaign using GEE analysis

Significant determinants of the reduction in negative beliefs were post-campaign (β= -0.689, CI= -0.896, -0.482), participants aged 40-49 (β= -0.351, CI= -0.636, -0.066), Malay (β= -0.617, CI= -1.157, -0.078) and participant's household income more than RM 10, 000 (β = -0.751, CI= -1.266, -0.237). Results from the post-campaign (β= -0.689, CI= -0.896, -0.482) showed a significant reduction in negative beliefs by -0.689 units. Those participants aged 40-49 (β= -0.351, CI= -0.636, -0.066) were more likely to have a reduction in negative beliefs by -0.351 units compared to participants aged 50-59. In comparison to Chinese participants, Malay (β= -0.617, CI= -1.157, -0.078) were more likely to have a reduction in negative beliefs by -0.617 units respectively. Participants' household incomes of more than RM 10, 000 (β = -0.751, CI= -1.266, -0.237) showed a significant reduction in negative beliefs compared to household incomes of less than RM 4, 000.

Table 4.31: Factors associated with a reduction of negative beliefs in belief about cancer and colorectal cancer screening among campaign recognisers using GEE analysis (n = 378)

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Intercept	4.278	.3721	3.548	5.007	**<0.001***
Overall Pre-Post					
Post-campaign	-.689	.1058	-.896	-.482	**<0.001***
Pre-campaign	0[a]	-	-	-	-
Age					
40-49	-.351	.1455	-.636	-.066	**0.016***
60 and above	-.169	.1713	-.505	.167	0.324
50-59	0[a]	-	-	-	-
Gender					
Female	-.045	.1395	-.319	.228	0.746
Male	0[a]	-	-	-	-
Ethnicity					
Others	-.438	.3885	-1.200	.323	0.259
Indian	-.191	.2921	-.764	.381	0.513
Malay	-.617	.2754	-1.157	-.078	**0.025***
Chinese	0[a]	-	-	-	-
Education					
Tertiary	-.061	.2643	-.579	.457	0.817
Secondary	-.294	.1897	-.666	.078	0.121
No formal education	-.367	.2212	-.801	.066	0.097
Primary	0	-	-	-	-
Household income					
< RM 4,000 (low)	-.751	.2626	-1.266	-.237	**0.004***
RM 4,000 - RM 10,000 (middle)	-.142	.1816	-.498	.214	0.434
> RM 10,000 (high)	0[a]	-	-	-	

Table 4.31: Continued

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
CRC History					
Yes	-.079	.1736	-.419	.262	0.650
No	0[a]	-	-	-	-
CRC Screening History					
No	-.073	.1963	-.458	.312	0.710
Yes	0[a]	-	-	-	-

* Generalized estimating equations analysis based on saturated model
* p-value < 0.05 are in bold
* [a] = Reference category (Reference category for each independent variable is changed to produce optimal estimates in the outcome)

4.5.4 Changes in attitude (anticipated delay in help-seeking) for each colorectal cancer (CRC) symptom after the campaign

4.5.4.1 Attitude (anticipated delay in help-seeking) (pre and post-campaign)

Table 4.32 presented the change in participants' duration of seeking a healthcare professional's consultation by showing the main symptoms of CRC before and after the BCAC-CRC. There is a significant difference in the participants who will seek a healthcare professional's consultation within two weeks with all of the colorectal cancer symptoms except for three. There is an increase in the number of participants who will seek a healthcare professional's consultation within less than two weeks with all symptoms of CRC after the BCAC-CRC. Over 90% of the participants would seek help within less than two weeks if presented with symptoms of CRC such as rectal bleeding (96.1%; p 0.001), blood in your stool (96.2%; p 0.004), looser stool for six weeks or more (96.0%; p 0.306) and persistent pain in your abdomen (95.3%; p 0.001) after the BCAC-CRC. Besides that, more participants agreed that they would get a healthcare professional's consultation within more than two weeks by presenting all the CRC symptoms.

Table 4.32: Proportions of anticipated delay in help-seeking for each CRC symptom (Pre-and Post-campaign) (n = 730)

CRC Symptoms	Duration	Pre n (%)	Post n (%)	*p-value (McNemar)*
How long would it take you to go to the doctor from the first time you noticed a				
Rectal Bleeding	<2 weeks	659 (91.5)	696 (96.1)	0.001*
	>2 weeks	61 (8.5)	28 (3.9)	
Abdominal Bloating	<2 weeks	416 (57.5)	422 (58.6)	0.736
	>2 weeks	307 (42.5)	298 (41.4)	
Blood in your Stool	<2 weeks	666 (92.5)	687 (96.2)	0.004*
	>2 weeks	54 (7.5)	27 (3.8)	
Looser Stool > 6 weeks	<2 weeks	684 (94.5)	694 (96.0)	0.306
	>2 weeks	40 (5.5)	29 (4.0)	
Persistent Pain in your Abdomen	<2 weeks	655 (90.5)	688 (95.3)	0.001*
	>2 weeks	69 (9.5)	34 (4.7)	
Unexplained Weight Loss	<2 weeks	615 (86.3)	605 (86.8)	0.861
	>2 weeks	98 (13.7)	92 (13.2)	

*Significant set at p <0.05

4.5.4.2 Improved attitude (anticipated delay in help-seeking)

Participants are considered to have a positive attitude if they agree to visit a doctor in less than 2 weeks upon noticing any of the CRC symptoms. A participant is considered to have an improved attitude if the total score of agreeing to visit a doctor in less than two weeks for all CRC symptoms in post-campaign was more than pre-campaign.

After the campaign, a total number of 227 (31.1%) participants showed an improved attitude to visit a doctor in less than two weeks upon noticing any of the CRC symptoms

(Table 4.33). The Wilcoxon's signed-rank test (W=-1.242, p=0.214) showed that the campaign had no significant changes in attitude after the campaign as the median scores remained the same (median=6, IQR 5.00, 6.00).

Table 4.33: Frequency distribution of improved attitude on anticipated delay in help-seeking

Improved attitude	**n (%)**
Attitude (anticipated delay in help-seeking) for each colorectal cancer symptom	227 (31.1)
Median score of attitude	**Median (Q1, Q3)**
Pre-campaign	6 (5.00, 6.00)
Post-campaign	6 (5.00, 6.00)
Wilcoxon's signed-rank test	W=-1.242, p=0.214

4.5.4.3 Factors associated with post-campaign attitude score on anticipated delay in help-seeking for each colorectal cancer symptom after BCAC-CRC using bivariate analysis

Post-campaign attitude score was significantly different by age, H (2) = 6.297, p=0.043. Pairwise comparison showed that the post-campaign attitude score was significantly higher (p=0.043) for participants aged 40-49 years (median= 6, IQR 5.00, 6.00) compared to participants aged 60 years and above (median= 5, IQR 5.00, 6.00). Results of the post-campaign attitude score were significantly different by ethnicity, H (3) = 8.536, p=0.036. Pairwise comparison showed that the post-campaign attitude score was significantly lower (p<0.001) for Chinese (median= 5, IQR 5.00, 6.00) compared to Malay, others, and Indian (median= 6, IQR 5.00, 6.00) respectively. A Mann-Whitney test showed that the post-campaign attitude score among those who recognise BCAC-CRC (median= 6, IQR 5.00, 6.00) is significantly higher than those who didn't recognise BCAC-CRC (median= 5, IQR 5.00, 6.00, 3.00, U=56,640.000, p=0.002).

Table 4.34: Factors associated with post-campaign attitude score

Variable	Post Knowledge Score Median (IQR)	z/t value	p-value
Age			
40-49 years	6 (5.00, 6.00)	Kruskal Wallis H (6.297)	0.043*
50-59 years	6 (5.00, 6.00)		
60 years and above	5 (5.00, 6.00)		
Gender			
Males	6 (5.00, 6.00)	Mann-Whitney (49,413.500)	0.214
Females	6 (5.00, 6.00)		
Ethnicity			
Malay	6 (5.00, 6.00)	Kruskal Wallis H (8.536)	0.036*
Chinese	5 (5.00, 6.00)		
Indian	6 (5.00, 6.00)		
Others	6 (5.00, 6.00)		
Marital status			
Single	5 (5.00, 6.00)	Mann-Whitney (34, 999.000)	1.171
Married	6 (5.00, 6.00)		
Education			
No formal education	6 (5.00, 6.00)	Kruskal Wallis H (2.021)	0.568
Primary	5 (5.00, 6.00)		
Secondary	6 (5.00, 6.00)		
Tertiary	6 (5.00, 6.00)		
Monthly income			
<RM 4,000	6 (5.00, 6.00)	Kruskal Wallis H (3.489)	0.175
RM 4,000-10,000	6 (5.00, 6.00)		
>RM 10,000	6 (5.50, 6.00)		

Table 4.34: Continued

Variable	Post Knowledge Score Median (IQR)	z/t value	p-value
CRC History			
No	6 (5.00, 6.00)	Mann-Whitney (34,953.000)	0.416
Yes	6 (5.00, 6.00)		
CRC Screening History			
No	6 (5.00, 6.00)	Mann-Whitney (26,063.000)	0.360
Yes	6 (5.00, 6.00)		
BCAC-CRC recognition			
No	5 (5.00, 6.00)	Mann-Whitney (56,640.000)	0.002*
Yes	6 (5.00, 6.00)		

*Significant set at p <0.05

4.5.4.4 Factors associated with improved attitude (anticipated delay in help-seeking) for each colorectal cancer (CRC) symptom after campaign using GEE analysis

Significant determinants of the improvement in attitude were post-campaign (β= 0.164, CI= 4.547, 5.262) and Indian (β = 0.237, CI= 0.081, 0.394).

Table 4.35: Generalised estimating equations analysis table to indicate the factors that influence improvement attitude in anticipated delay in help-seeking for each CRC symptom after campaign (n = 730)

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Intercept	4.904	.1823	4.547	5.262	**<0.001***
Overall Pre-Post					
Post-campaign	.164	.0648	.037	.291	**0.011***
Pre-campaign	0[a]	-	-	-	-
Age					
60 and above	-.036	.0986	-.229	.157	0.716
50-59	-.050	.0830	-.213	.112	0.545
40-49	0[a]	-	-	-	-
Gender					
Female	.004	.0794	-.152	.159	0.963
Male	0[a]	-	-	-	-
Ethnicity					
Others	.207	.1167	-.021	.436	0.076
Indian	.237	.0796	.081	.394	**0.003***
Chinese	-.128	.1450	-.412	.157	0.379
Malay	0[a]	-	-	-	-
Marital Status					
Single	.102	.1136	-.120	.325	0.368
Married	0[a]	-	-	-	-
Education					
Tertiary	.065	.1734	-.275	.405	0.707
Secondary	.017	.1032	-.185	.219	0.868
Primary	.079	.1125	-.142	.299	0.485
No formal education	0	-	-	-	-
Family income					
> RM 10,000 (high)	.236	.1986	-.154	.625	0.236
RM 4,000 - RM 10,000 (middle)	-.075	.1131	-.297	.147	0.508
< RM 4,000 (low)	0[a]	-	-	-	-
CRC History					
Yes	.046	.0889	-.128	.220	0.605
No	0[a]	-	-	-	-

Table 4.35: Continued

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
CRC Screening History					
Yes	.094	.1183	-.138	.326	0.428
No	0[a]	-	-	-	-
BCAC-CRC recognition					
Yes	.139	.0853	-.028	.307	0.102
No	0[a]	-	-	-	-

*Significant set at p <0.05
* a = Reference category

4.5.4.5 Factors associated with improved attitude (anticipated delay in help-seeking) for each colorectal cancer (CRC) symptom among campaign recognisers using GEE analysis

Significant determinants of the improvement in attitude were post-campaign (β= 0.238, CI= 0.094, 0.383).

Table 4.36: Generalised estimating equations analysis table to indicate the factors that influence improvement attitude in anticipated delay in help-seeking for each CRC symptom among campaign recognisers (n = 411)

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Intercept	4.423	.3079	3.819	5.027	**<0.001***
Overall Pre-Post					
Post-campaign	.238	.0735	.094	.383	**0.001***
Pre-campaign	0[a]	-	-	-	-
Age					
40-49	.145	.1217	-.093	.384	0.233
50-59	.148	.1097	-.067	.363	0.176
60 and above	0[a]	-	-	-	-
Gender					
Female	.006	.0951	-.181	.192	0.954
Male	0[a]	-	-	-	-
Ethnicity					
Others	.010	.3261	-.629	.650	0.974
Indian	.410	.2312	-.043	.863	0.076
Malay	.086	.2393	-.383	.555	0.718
Chinese	0[a]	-	-	-	-
Marital Status					
Married	.217	.1238	-.025	.460	0.079
Single	0[a]	-	-	-	-
Education					
Tertiary	.241	.1835	-.119	.600	0.190
Secondary	.129	.1615	-.188	.445	0.425
Primary	.026	.1713	-.310	.362	0.879
No formal education	0	-	-	-	-
Household income					
> RM 10,000 (high)	.258	.1770	-.088	.605	0.144
RM 4,000 - RM 10,000 (middle)	.077	.1022	-.124	.277	0.454
< RM 4,000 (low)	0[a]	-	-	-	

Table 4.36: Continued

Independent Variable	β	SE	95% Wald Confidence Interval		p-value
			Lower	Upper	
Ethnicity					
Others	.010	.3261	-.629	.650	0.974
Indian	.410	.2312	-.043	.863	0.076
Malay	.086	.2393	-.383	.555	0.718
Chinese	0[a]	-	-	-	-
Marital Status					
Married	.217	.1238	-.025	.460	0.079
Single	0[a]	-	-	-	-
Education					
Tertiary	.241	.1835	-.119	.600	0.190
Secondary	.129	.1615	-.188	.445	0.425
Primary	.026	.1713	-.310	.362	0.879
No formal education	0	-	-	-	-
Household income					
> RM 10,000 (high)	.258	.1770	-.088	.605	0.144
RM 4,000 - RM 10,000 (middle)	.077	.1022	-.124	.277	0.454
< RM 4,000 (low)	0[a]	-	-	-	
CRC History					
No	.108	.1020	-.092	.308	0.289
Yes	0[a]	-	-	-	-
CRC Screening History					
No	.101	.1438	-.181	.383	0.481
Yes	0[a]	-	-	-	-

* Generalised estimating equations analysis based on saturated model
* p-value < 0.05 are in bold
* [a] = Reference category (Reference category for each independent variable is changed to produce optimal estimates in the outcome)

CHAPTER 5: DISCUSSION

5.1 Introduction of this chapter

In this chapter, I will discuss the findings of my research and compare them with those of other studies. This will help to explain the results of my research in the context of similar studies conducted in the field. Comparing results is crucial in conducting research.

The discussion is designed to provide a comprehensive understanding of the key aspects involved in improving Malaysians' knowledge of colorectal cancer (CRC) symptoms and changing their negative beliefs and attitudes towards CRC screening. This is particularly important in the context of introducing a mass-media campaign aimed at increasing CRC symptom knowledge and screening participation among Malaysians, especially those over 40 years old. These key aspects primarily consist of three tiers:

1. Factors indicating low levels of CRC symptom knowledge and barriers to CRC screening among Malaysians
2. The process of designing a culturally adapted intervention – a mass-media campaign
3. The implementation and reach of introducing this culturally adapted intervention programme, which was an organised mass-media campaign that contributed to enhanced CRC awareness (knowledge, attitude, and beliefs) and CRC screening practices (belief and experience) among Malaysians.
4. The changes on CRC awareness (knowledge, attitude, and beliefs) and CRC screening practices (belief and experience) among Malaysians after the implemented mass-media campaign.

The process of discussion was carried out in an organised manner that aligned with the study's objectives. Therefore, this chapter begins by discussing the factors that indicate a

low level of symptom knowledge of CRC and barriers to CRC screening among Malaysians. Subsequently, the discussion focuses on the process of designing a culturally adapted intervention – a mass-media campaign. It then delves into the implementation and reach of introducing this culturally adapted intervention programme, which was an organised mass-media campaign that contributed to enhanced CRC awareness (knowledge, attitude, and beliefs) and CRC screening practices (belief and experience) among Malaysians.

The discussion in this chapter revolves the changes brought about by the implementation of a new and culturally appropriate intervention programme, which includes a CRC mass-media campaign approach in Malaysia. The changes observed relate to the awareness of CRC (knowledge, attitude, and beliefs) and CRC screening practices (belief and experience) among Malaysians.

5.2 Systematic Review

5.2.1 Awareness of colorectal cancer symptoms among Malaysians

Awareness of symptoms has been addressed in ten studies among all the thirteen CRC studies. All these studies have been carried out in Malaysia's most developed seven states. Recent research among friends and relatives accompanying patients to the University Malaya Medical Centre, Kuala Lumpur, showed poor awareness (less than 40%) of recognising CRC symptoms (Hilmi et al., 2010b). In another study, respondents who live in the rural Perak (Malaysia) area have also shown that fewer than 50% of participants have correctly recognised CRC symptoms (Tin Tin et al., 2013). This indicates that rural and urban populations are unaware of CRC symptoms. Likewise, a study with 350 outpatients from Mayo General Hospital, Ireland, also concluded that 26.6% of participants were able to recognise only one CRC symptom (Manning et al., 2006), suggesting that awareness is limited in the low- and middle and high-income countries.

The findings of this study indicated that the most commonly evaluated symptoms of CRC are ‘change in bowel habits’ and ‘weight loss.’ In accordance with the present study finding, the previous United Kingdom research finding concluded that ‘change in bowel habits’ (Kirsten McCaffery et al., 2003; E. Power et al., 2011; Robb et al., 2009b; Yardley et al., 2000a) and ‘weight loss’ (Jalleh et al., 2010; McVeigh et al., 2013; Nasaif & Al Qallaf, 2018; E. Power et al., 2011; Robb et al., 2009b; Yardley et al., 2000a) were identified as the symptom of CRC by <30% of participants. Two studies have found that over 50% of Malaysians could recognise ‘abdominal pain’ as one of the main symptoms of CRC from four selected studies. Previous research in Western Australia, the UK, and Kuwait (Christou & Thompson, 2012; E. Power et al., 2011; Saeed et al., 2018) have found that over 55% of participants are aware of 'abdominal pain' as a symptom of the CRC.

Another study in the UK instead disagrees with this result (Yardley et al., 2000a). More than 55% of Malaysians recognised both ‘blood in the stool’ and ‘bleeding’ as CRC symptoms. This systematic review reveals that there is higher awareness about ‘blood in the stool’ and ‘bleeding’ among Malaysians compared to the United Kingdom, Ireland, the Gulf, and the UK, which demonstrates that less than 40% of the people are aware of the symptoms above (Kirsten McCaffery et al., 2003; McVeigh et al., 2013; Nasaif & Al Qallaf, 2018; Robb et al., 2009b; Yardley et al., 2000a).

5.2.2 Barriers to colorectal cancer screening among Malaysians

All the studies that have evaluated barriers to CRC screening have been conducted on respondents who are over 18 years old and live in urban areas such as Negeri Sembilan, Kuala Lumpur, and Selangor. The current systematic study found that the Western Malay participants recognised the least frequently (less than 40%) identified barriers to CRC screening. Some of the barriers discussed in a recent study among participants aged over

50 years from a rural area in the US were similar to the findings of this study, for example, fear (25.4%), financial barriers (25.4%), no recommendation or reference from healthcare professionals (33.1%), and distress (10.2%) (Muthukrishnan et al., 2019). One strategy to rectify Malaysia's financial problems with CRC screening is to determine ways to lower test costs and improve insurance coverage. Another alternative could be improving insurance coverage and promoting better information.

This review also pinpointed that researchers from two studies asked respondents that the 'Faecal Occult Blood Test (FOBT) is a 'painful test' (53.5%). The above clearly shows that participants are unaware of the process of the FOBT test since it is a test just using a stool sample that is unlikely painful. The next perceived barrier to screening was anxiety about knowing the screening outcome ('fear of the results'). Data from a study conducted at a safety-net clinic in the Western United States in 2015 supports this statement. Pacific Islander (30%) and white (9%) among the three principal ethnic groups in the study responded slightly like Malaysians, which is 'afraid to find out about the test result' as the main issue for them not being screened (Nagelhout et al., 2017). The two most identified barriers to CRC by Malaysians were 'screening is embarrassing' (55.1%) and 'fear of discomfort' (63.8%). A study investigated the association of CRC screening with embarrassment and discovered that 49% of African – Americans felt that CRC screening was embarrassing (Bo et al., 2010). Another study showed that less than 35% of Saudi Arab and Western United Americans confessed to being uncomfortable or embarrassed with a CRC screening test, contradictory to the Malaysians (Alduraywish et al., 2020; Nagelhout et al., 2017). This might be interconnected to knowledge inadequacies, negative beliefs, and attitudes concerning CRC screening and the assumption that CRC screening is a non-standard medical procedure.

Besides, Malaysians have little knowledge of the significance and importance of CRC screenings because of the shortage of population-based screenings and screening

referrals by professional healthcare providers. The Hong Kong study discovered that the 'cost' was the primary barrier to CRC screening, which was agreed by 86% of participants (M. C. S. Wong et al., 2013). A cross-sectional study of the barriers to CRC screening among individuals at risk for CRC in Omaha's central metropolitan area indicated that 'fear of cancer diagnosis' (42%), 'embarrassment' (35%), and 'screening test cost' (44%) appeared to be the most significant screening barriers (Stacy et al., 2008). Low awareness and negative thoughts about CRC screening can be key factors in this negative attitude, such as embarrassment, fear, and pain. Leung et al. and his research team pointed out that cultural beliefs such as faecal aversion may lead to embarrassment (Leung et al., 2017). In addition, a recent systematic review included 83 research studies of high-income countries on the most commonly discussed barriers to CRC screening. Few of them were in accordance with the findings of this survey (Idris Guessous et al., 2010).

5.3 Develop, validate, and implement the colorectal cancer awareness mass media campaign with adapted Malaysian culture as an intervention

This study aimed to develop a culturally adapted mass-media campaign to raise awareness of colorectal cancer (CRC) in Malaysia. There is a lack of evidence of culturally adapted health-related campaigns, specifically for CRC, in Malaysia. However, many studies have been conducted in other countries, where culturally adapted campaigns have been successful. Therefore, a similar study is needed in Malaysia to address the gap in cultural acceptability of the CRC awareness campaign. This study is an additional effort for Malaysians to create a CRC mass-media campaign that is tailored to the local culture. An educational program tailored for American Indian populations demonstrated the importance of culturally sensitive messaging in encouraging CRC screenings. The key findings included higher participation rates in CRC screenings due to messages that respected cultural beliefs and addressed common barriers like trust and communication

gaps with healthcare providers (Menon et al., 2022). Similarly, a multilingual navigator program helped increase screening rates in underserved, low-income communities by using trained navigators to guide patients through the process, overcoming logistical and language barriers (Percac-Lima et al., 2009). According to a meta-analysis of 38 studies on interventions, 17 interventions were culturally tailored with aspects of ethnically matched facilitators and ethnographic research to fit with African-American communities. Most interventions focused on skill development and were delivered in small groups over two to thirty days with two to five sessions. The interventions resulted in a reduction in sex-risk behaviours among heterosexual African Americans. This demonstrates that cultural adaptation of an intervention is a factor associated with intervention success (Darbes et al., 2008). Therefore, this study developed the cultural adaptation of mass media campaigns followed by the Heuristic Framework, which Barrera and Castro proposed. The Heuristic Framework consisted of five stages: information gathering, preliminary design, preliminary testing, and refinement.

Researchers have identified the Be Cancer Aware Campaign (BCA) run by the Public Health Agency Northern Ireland (PHA NI) as a successful mass-media campaign to improve awareness about different types of cancer in Northern Ireland. The findings of these campaigns reported an increase in awareness of cancer symptoms, an increase in patients reporting campaign-related cancer symptoms during doctor visits, and a trend towards earlier-stage diagnosis in areas where the campaign was implemented. The National Institute for Health Northern Ireland from the United Kingdom allowed Malaysian researchers to adapt the Be Cancer Aware campaign materials according to Malaysian culture. Throughout the development of the campaigns, extensive efforts were made to ensure that the original campaign and its adaptation for Malaysians were easily understood. The cultural adaptation of campaign materials took into consideration

language, culture, and environment to ensure compatibility with Malaysian cultural patterns, meanings, and values (Bernal et al., 2009).

In our study, mass media was chosen as a campaign approach because it is known as a mode of communication that reaches the general population (Randolph & Viswanath, 2004). Randolph and his team demonstrated this through their public health programmes to improve healthier behaviours and create awareness about various health issues (Randolph & Viswanath, 2004). A culturally adapted oral cancer mass media campaign in Michigan has increased patient requests for screening followed by the campaign. This is mainly aimed at African-American men to increase patients' chances of survival through early cancer detection (Ismail et al., 2012). As for awareness about health, the mass media can serve as a vital ally by connecting health promotion advocates with the general population (Naveena, 2015). Mass media is an efficient means of influencing mass audiences to adopt new behaviours or reminding them of vital health information. This is due to its broad reach, low cost, and simple message. Moreover, considering that the majority of people, especially in rural regions, do not regularly interact with medical professionals, the mass media continues to be an effective means of increasing public awareness and knowledge of health information (Miyawaki, 2017).

According to a study conducted by Murray et al., adapting to different cultures can be a challenging process as every country has its own unique set of difficulties. In Malaysia, the multi-ethnic population posed the biggest obstacle when it came to adapting campaign materials. Cultural adaptation interventions are typically aimed at minority communities, such as Africans or Chinese Americans (Davidson et al., 2013; Murray et al., 2017). Nevertheless, adapting interventions that describe constraints faced by multi-ethnic populations can promote cancer screening in general, not just for minority populations, which also will be essential for countries such as America, Africa and Serbia with various or immigrant populations (Cvijović et al., 2016; Leeks et al., 2012; Wang et al., 2012).

Hence, we are currently adapting our cultural approach and evaluating the effectiveness of the BCAC campaign in engaging with the intended audience. Based on feedback from group and expert discussions, it was suggested that the campaign's messages should be better aligned with the cultural beliefs of each ethnic group. As a result, a colon image was added to printed materials to aid community understanding. Additionally, experts advised that campaign materials should be easily comprehensible to the local community. Therefore, during the cultural adaptation process, we replaced some difficult words in the key messages, posters and media dialogues with simpler alternatives to increase understanding.

Since Malaysia is a multi-ethnic country, language poses a significant barrier to effectively communicating the key campaign message. To overcome this challenge, we created campaign brochures in multiple languages to cater to every ethnic group in Malaysia. This approach is consistent with a study conducted in the United States of America, where researchers developed a culturally tailored breast cancer awareness video in Chinese languages (Mandarin and Cantonese) to reach and engage with the American Chinese community (Wang et al., 2012). The banners, billboards, and buntings are only displayed in the Malay language, and people who have poor fluency in the Malay language may not have adequately understood the displayed messages. This is due to the requirement, as stated by Selayang Municipal Council and Dewan Bahasa Pustaka that printed materials displayed in public places must be in the Malay language. So that the posters and roll-up banners in government clinics, government hospitals, private clinics, and supermarkets were presented in Malay and English. It was printed in English, especially to reach those not fluent in Malay. Even though Malaysians learn Malay, there are still a few people who struggle to read and understand the language. This is due to Malaysia's multilingual education system, which includes primary (Malay, Tamil, and Chinese) and secondary (Malay and Chinese) schools. The Malay language fluency is

only sufficient for basic communication, and they couldn't understand technical or medical terminology. Besides, the neighborhoods are among their ethnicity, where their primary communication language won't be Malay.

The selection of TV and radio channels is closely tied to ethnic and language preferences, so advertisements have been created in multiple languages and broadcast through various media channels. Due to research funding limitations, these ads have been restricted to selected channels, but they cover all ethnicities in Malaysia. TV ads target both Malay and Chinese populations, while radio ads target Malay and Indian populations. Since the majority of Malaysians are Malay, both TV and radio ads are in Malay.

5.4 The reach, feedback, and factors associated with the recognition of culturally adapted intervention for Be Cancer Alert- colorectal cancer campaign among the community from Rawang, Selangor

5.4.1 The reach of culturally adapted intervention for Be Cancer Alert- colorectal cancer campaign among the community from Rawang, Selangor

Previous researchers documented that the evaluation of CRC awareness-raising campaigns was lacking in outcome measures of effectiveness for Asian countries, especially Malaysia (Loh, 2017a). In this study, the evaluation for pre and post-intervention was knowledge, attitude, and belief (awareness raising), and in post-intervention was the reach and feedback of BCAC-CRC among the respondents. The pre-campaign household survey discovered that participants had poor knowledge, attitudes, and beliefs about CRC and CRC screening. This study believed that the BCAC-CRC improved the respondents' awareness of knowledge, attitudes, and beliefs about CRC and CRC screening. As far as we know, the BCAC-CRC mass media campaign is the first in Malaysia that has been evaluated for the effectiveness of the campaign as an intervention.

This study was able to improve awareness about CRC and CRC screening among Malaysians.

Overall, the BCAC-CRC managed to reach the communities in Rawang. Television advertisements and printed materials were the most commonly recognised media by the population. The finding from this study is in accordance with findings from the Be Clear On Cancer campaign on awareness of lung cancer campaigns (61%) (PHA, 2015b). Besides that, another study on oral cancer in Malaysia by Saleh and his research team also documented that their respondents had seen television advertisements at least once, with an average frequency of 3.3 times per respondent (Saleh et al., 2012). In addition, other studies from Australia and Scotland found that television advertisements achieved the highest reach among respondents (74% and 67%, respectively) on knowledge and awareness of alcohol and cancer (Dixon et al., 2015; Eadie et al., 2009).

The Malay ethnic group had the highest exposure to the BCA-CRC campaign through television advertisements and printed materials. This may be attributed to the language used, as Bahasa Melayu, which is Malaysia's national and official language, was used for television advertisements and printed materials such as banners and billboards. This could be the main reason why the campaign reached a larger audience among the Malay population. The radio advertisements were broadcasted in Tamil (Thr Raaga) and English (Lite FM), which may have contributed to increased exposure among the Indian population.

Although the reach of all types of mass media (television, radio, printed material) among the Chinese population was low compared to other ethnicity, television advertisement was still reported as having the highest reach compared to different types of mass media. Despite the fact that television advertisements were aired for five weeks on one of the most commonly watched Chinese TV channels (8TV). Although brochures were created in Mandarin, only 20% of Chinese respondents in this survey were aware of

the campaign materials. Similar findings were observed in the last BCAC- Breast cancer campaign, where Chinese participants had the lowest recognition of campaign materials (25.5%) compared to Malay and Indian participants (Schliemann, Htay, et al., 2020). The campaign possibly reached the Chinese population; however, we could not get their response due to the language barrier. During the household survey, most of the Chinese participants were not fluent in English or Malay, and this study has limited Mandarin, Cantonese, or Hakka-speaking enumerators. As Malaysians mostly watch Astro channels, any mass-media campaign should include Astro Chinese channels to disseminate cancer education messages in order to reach the Chinese community. However, we were unable to air on Astro due to limited research funds.

All mass-media campaign materials have a greater reach among female participants than male participants. This could be attributed to the fact that the majority of females are homemakers who are exposed to television advertisements.

Although television advertisements are well known for their broad reach and are recommended media for conveying health-related information to the communities (Suppiah P, 2002), the television advertisements in this study only managed to reach 42% of the population. This finding is relatively low as compared to other studies. This is because most of Rawang's population watches Astro channels, and this study is unable to pay Atstro to telecast our television advertisement due to limited research funds.

A study conducted by Gignon et al. found that displaying health-related posters or brochures in hospitals or clinics is an inexpensive and effective way to reach communities. In the study, printed materials such as posters and brochures displayed in clinics were the second most popular source of information about health-related issues among Rawang populations. The respondents appreciated the availability of the brochure in multiple languages, as it allowed them to read and understand information about colorectal cancer in their native language. A study conducted in India and Serbia also

found that posters and brochures are the most appropriate communication channel (71.4% and 71%, respectively) for disseminating information about breast and cervical cancer prevention in health facilities (Cvijović et al., 2016; Kulkarni et al., 2022).

This study shows that printed materials only reached 40% of respondents, which is comparatively low compared to other studies. Even though private and government clinics are important public places, printed materials still didn't reach many respondents. This is because those places are only attended by those who are sick, and people accompany them. Furthermore, printed materials such as bunting and banners displayed throughout Rawang might not catch the respondent's attention. This is because those were hung in unstrategic places such as traffic lights and light poles, where people cannot read while driving.

5.4.2 The participant's feedback on culturally adapted Be Cancer Alert-colorectal cancer campaign materials among the community from Rawang, Selangor

More than 80% of participants in this household survey agreed that the BCAC-CRC campaign advertisements (television and radio) and printed materials were appropriate for Malaysian culture. Most of the participants of this study felt that the information on CRC from television advertisements was relevant (55.8%) and thought-provoking (47.7%) to them. This showed that television advertisements were more effective in transmitting information about CRC by using a cancer survivor as a visual aid. The survivor's facial expressions and emotions easily influenced participants to think that CRC has a better prognosis if detected early. However, it should be noted that the findings from this study are slightly lower than the results from England's Be Clear On Cancer-Bowel campaign (relevant=67%) and Malaysia's Be Cancer Alert- Breast Cancer campaign (relevant = 69% and thought-provoking= 60%) (J Moffat et al., 2015;

Schliemann, Htay, et al., 2020). This suggests that CRC is found to be slightly less relevant to Malaysians compared to breast cancer.

255 (34.9%) of the participants reported that they had discussed BCAC-CRC campaign advertisements with their close friends and relatives. As a result, this campaign managed to encourage 144 (19.4%) of the participants, a member of their immediate family, or a close friend to visit a healthcare professional for a medical consultation. This is in accordance with a cancer awareness campaign known as 'Be Clear On Cancer', which led to an increase in the number of individuals visiting cancer clinics in the United Kingdom (UK). The increase in attendance was observed to be 29% higher for colorectal cancer and 63% higher for lung cancer, which was a comparison result between the campaign in the years 2011 and 2012.

After being exposed to the BCAC-CRC campaign, 9.6% of the participants developed a more positive attitude towards CRC. This optimistic outlook is expected to lead to a significant improvement in their screening behaviour and acceptance of CRC screening. A better outcome was reported in Australia, where the screening uptake among those exposed to the seven-week mass-media campaign was relatively higher compared to those who were not exposed to the campaign (Durkin et al., 2020).

5.4.3 The factors associated with the recognition of culturally adapted intervention for Be Cancer Alert- colorectal cancer campaign among the community from Rawang, Selangor

The exposure of any mass media campaign materials was high among participants aged 50-59. This may be because middle-aged people are at higher risk of having any diseases, as such they will be more alert on any health-related information compared to those in the younger age group. On the other hand, elderly people (60 and above) are less likely to recognise campaign materials due to blurred vision (Wilson et al., 2021). Despite

showing campaign materials during the household survey, some elderly even had difficulty recognizing the campaign material.

The study found that Chinese participants were less likely to recognise the campaign materials as compared to other ethnicities despite the fact that the television advertisement and brochures were created in Mandarin language. This could be because most of the Chinese participants were more familiar with Hakka and Cantonese languages than with Mandarin. Another reason for the limited reach of the campaign among the Chinese could be attributed to the unpopularity of the 8TV channel as compared to the Astro channel. Due to limited research funds, the campaign couldn't air on Astro channels, which Malaysians widely watch.

The study also found that participants who have received formal education, i.e., secondary and tertiary education, were more likely to be exposed to any mass-media campaign materials as compared to those who haven't received formal education. The findings from the BCA primer campaign in Northern Ireland also support this observation, which found that the campaign's reach among the population with a lower education background was poor (Public Health Agency, 2015). A similar finding by Akbolat et al. suggests that the level of education plays a role in the choice of information source among patients diagnosed with cancer, along with other associated factors like age and race (Akbolat et al., 2021).

5.5 The effectiveness of the Be Cancer Alert - colorectal cancer campaign on awareness raising (knowledge, attitude, and beliefs) about colorectal cancer and screening (belief and experience) among the community in Rawang, Selangor

A systematic review by Désirée et al (2019) concluded that there is insufficient evidence of the effectiveness of mass-media campaigns in raising awareness about CRC

in Asian countries, including Malaysia (Schliemann et al., 2019). Therefore, this study aims to design and implement various types of mass media campaigns to raise awareness about CRC and evaluate their effectiveness.

5.5.1 The effectiveness of the Be Cancer Alert - colorectal cancer campaign on awareness raising for knowledge among the community in Rawang, Selangor

Following the campaign, the majority of participants (67.4%) recognised a symptom of colorectal cancer (CRC). However, the percentage of participants who identified "blood in the stool" as a CRC symptom significantly increased by 13.4% after the campaign (pre-campaign = 54.0%, post-campaign = 67.4%). "Blood in the stool" was the most common and important symptom of CRC, and this message was highlighted in all campaign materials, including television, radio, and print. This indicates that the campaign was successful in improving participants' knowledge of CRC symptoms, as demonstrated by a study conducted by Public Health England on the effectiveness of the Be Clear on Cancer campaign. The study showed that there was a 14% increase in the proportion of people who recognised "blood in the stool" as a key symptom of CRC following the campaign (J. Moffat et al., 2015). Although 'blood in stool' was the most commonly identified symptom, recognition of 'pain in the back passage' significantly increased by 17.5% (pre-campaign= 35.1%, post-campaign= 52.6%). This shows that BCAC-CRC had increased awareness and receipt of new knowledge on CRC symptoms especially pertaining to 'pain in back passage among the participants.

Participants' knowledge of each mentioned risk factor and CRC symptoms increased following the campaign. The highest proportion of participants who identified "having a colorectal disease" and "eating red or processed meat once a day or more" as CRC risk factors after the campaign were 72.3% and 71.1%, respectively. In contrast, a cross-

sectional study conducted by Pan et al. (2017) reported that only 32.5% of respondents recognised “having a colorectal disease” as a risk factor, and 49.0% recognised “eating red or processed meat once a day or more” as a risk factor, which was found to be lower compared to this study (Pan et al., 2017). It was surprising to find that the highest increase (pre-campaign= 39.9%, post-campaign= 52.7%) in the proportion of participants was among those who recognised ‘being over 70 years old’ as a risk factor of CRC. This study’s pre-campaign findings reflect two other cross-sectional studies conducted in Malaysia by Su et al. (2013) and Sindhu et al. (2019) reporting respectively 33.6% and 39.9% of participants who recognised ‘being over 70 years old’ as a risk factor for CRC (Sindhu et al., 2019; Su et al., 2013b). However, it should be noted that these studies were only baseline surveys, proving that BCAC-CRC has educated participants to improve their knowledge of each risk factor.

In the post-campaign, all participants, specifically campaign recognisers who completed tertiary and secondary education were more likely to have better knowledge of CRC as they have a more inquisitive nature compared to those with lower education (Sani et al., 2016). Apart from that, education also plays a key role in having better health literacy to create awareness of CRC (Jansen et al., 2018). Higher formal education can be seen as a good predictor in improving knowledge on CRC upon the implementation of this campaign. The finding from this study is consistent with earlier studies conducted in Malaysia and Saudi Arabia, which indicated individuals with higher educational backgrounds are more aware of the indications and symptoms of CRC (Su et al., 2013b; Zubaidi et al., 2015). Another Saudi Arabian study demonstrated that differences in CRC knowledge are strongly driven by educational level (Khayyat & Ibrahim, 2014). Additionally, another study conducted in Northern Ireland indicated that individuals with lower educational backgrounds have very little awareness of cancer symptoms (Keeney et al., 2011).

The recent Malaysian National Cancer Registry (2012 – 2016) reported Chinese to have the highest incidence of CRC followed by Malays and Indians (Azizah AM., 2019). However, the finding of this study showed that Chinese were less likely to have an increased knowledge of CRC compared to Malays and Indians after the campaign, specifically campaign recognisers. This was found to be worrisome as the Chinese population who are at the highest risk of CRC seem to be ignorant in gaining knowledge on CRC. However, this outcome may also be partially attributable to the limited campaign reach to a substantial portion of Chinese participants. The results from this study were echoed by Hilmi et al. (2010) and Su et al. (2013), who discovered that the Chinese had less knowledge about CRC than Malays and Indians (Hilmi et al., 2010a; Su et al., 2013b).

Although the findings from this study may seem insignificant, they indicate that participants from middle-income households gained more knowledge about CRC (colorectal cancer) after the campaign, particularly those who recognised the campaign. On the other hand, those from lower-income households had less knowledge of CRC in general, which confirms the link between a person's socioeconomic status and their knowledge of CRC. These results are consistent with prior research that has established the connection between socioeconomic status and CRC knowledge attainment (Brunswick et al., 2001; Robb et al., 2009a).

During the post-campaign period, it was found that participants who had friends or family members with a history of CRC showed an increased level of knowledge about CRC. However, this was not the case for those who recognised the campaign. This can be attributed to the fact that those who had friends or family members with CRC were able to gain some knowledge about the condition through their interactions with them. These findings are consistent with a study conducted in Saudi Arabia, which recruited 600 individuals from Riyadh city malls and found that individuals with a family history of CRC had a higher level of knowledge about the condition (Kassim, 2015).

Overall, this study found that knowledge about CRC among the participants improved after the campaign, more specifically among those who noticed our campaign materials. Based on these findings, the primary goal to increase knowledge about CRC symptoms was achieved successfully by implementing the BCAC-CRC campaign.

5.5.2 The effectiveness of the Be Cancer Alert - colorectal cancer campaign on awareness raising for belief towards cancer and colorectal cancer (CRC) screening among the community in Rawang, Selangor

The study results showed a significant decrease in four negative cancer beliefs after the campaign. Among the participants, the statement "I would NOT want to know if I had cancer" had the highest reduction rate (pre-campaign= 40.0%, post-campaign= 22.3%). Additionally, a study conducted in six European countries found that 11% of the participants agreed with the negative statement, "I would not want to know if I had cancer" (Pedersen et al., 2018). It is natural to feel fear and anxiety after discovering a cancer diagnosis (Greiner et al., 2004). However, early detection and treatment can lead to better results and greater chances of survival; as such, it is important to overcome this negative belief.

There is a significant reduction in the proportion of those who agreed to the negative statement, 'Colorectal cancer screening is only necessary if I have symptoms.' This showed the campaign's effective influence in positively increasing participants' perceptions towards CRC screening and the importance of early screening. This also most likely represents a progression toward more optimistic attitudes toward cancer and cancer screening (Progovac et al., 2019).

The number of participants who agreed to the statement 'I would be so worried about what might be found at a colorectal cancer screening that I would prefer not to do it' minimally increased in the post-campaign. It is reasonable to be scared or concerned

about the likelihood of being diagnosed with CRC. It is also relatively common for people to feel nervous or frightened about undergoing CRC screening tests (Yusoff et al., 2012b). Furthermore, screening tests for CRC can discover abnormalities in the colon or rectum before symptoms appear (Institute of & National Research Council National Cancer Policy, 2003; Young, 2018). However, it is important to realise that discussing any doubts or questions concerning CRC screening with a medical professional could be helpful. Medical professionals may give advice and guidance regarding the benefits and risks of screening and how to tackle worries or fears (Subramanian et al., 2004). Unfortunately, the findings found that there are people who do not realise that screening can lead to earlier treatment and improved survival rates (Institute of & National Research Council National Cancer Policy, 2003). Therefore, one should weigh the potential benefits of early detection and treatment against the temporary discomfort or anxiety associated with the screening test. Contrary to the findings from this study, in England, a mass media campaign called 'Be Clear on Cancer' – bowel campaign reported that the proportions of participants agreeing to the negative statements 'worrying about what the doctor could find' and 'being too scared' had decreased dramatically from the year 2010 to 2012 (Power et al., 2011).

In general, negative beliefs in cancer and CRC screening vary based on age and generational factors. The results of the multivariate analysis of this study reported a significant increase in negative belief among middle-aged (50-59 years) participants as compared to younger (40-49 years) participants after the campaign, particularly among campaign recognisers. As people age, they often become more concerned about their life span. Hence, the fear of cancer can be magnified as one gets older. In addition, older individuals may hold stronger stigma and taboos related to cancer which can contribute to more negative views (Goldman et al., 2009). On the other hand, people of the younger generation tend to have a more optimistic opinion about cancer and CRC screening (Al-

Azri et al., 2020). Therefore, this influences their acceptance of invasive screening procedures. Moreover, the American Cancer Society encourages those with a moderate risk of colorectal cancer to regularly get screened once they reach the age of 45 (Arif Kamal, 2020).

In terms of ethnicity among campaign recognisers, Indians and Chinese were found to have a reduction in negative beliefs after the campaign. Though they were found to be significant, the estimates did not deviate too much from Malays. Therefore, this shows that beliefs about cancer can be deeply rooted in cultural and societal norms that make it harder to inculcate positive beliefs about cancer. Cultural beliefs and taboos surrounding cancer may contribute to negative perceptions or stigmatisation of the disease (Arafa & Farhat, 2015). In addition, traditional or alternative healing practices can delay and substitute advanced medical treatments which may also affect their beliefs about cancer outcomes (Attum et al., 2023; Broom et al., 2009).

Another finding from this study reported that participants with tertiary and secondary education demonstrated an insignificant with minimal reduction in their overall negative beliefs after the campaign. Theoretically, it is claimed that populations with higher levels of education may have more optimistic cancer beliefs because they are more knowledgeable about the significance of cancer prevention and early detection (Raghupathi & Raghupathi, 2020). Also, they may be keener on finding accurate information regarding cancer and its treatment. It could be explained by the fact that people with higher education levels are more likely to have access to healthcare knowledge regarding the advantages of CRC screening, resulting in a more positive approach towards CRC screening (Willems & Bracke, 2018).

Generally, married individuals are capable of providing more social support and emotional stability to their spouse, which may positively impact their perspective on cancer and their ability to cope with the diagnosis (El-Haddad et al., 2015). This statement

is in line with the study's findings that married campaign recognisers shows an insignificant with minimal reduction in their overall negative beliefs. Married individuals are more likely to encourage and accompany their spouses to cancer screenings (van Jaarsveld et al., 2006). This is demonstrated by a national survey study of adults in the United States revealing that married individuals were more likely to have positive beliefs about cancer than unmarried individuals. Specifically, married people seem to be more optimistic that 'cancer is treatable if diagnosed early', 'cancer is not a death sentence', and 'cancer treatment is effective'. It has been suggested that married status may be a surrogate for social support, which can influence cancer beliefs positively (Hay, 2014).

It is interesting to note that while the campaign was successful in changing the negative beliefs of some people, others were not affected. Specifically, single individuals showed minimal or no change in their overall negative beliefs about cancer. This is probably because, the current generation single individuals are tend to be more proactive in learning about cancer prevention and adopting a healthy lifestyle by reducing their risk of developing the disease. They often believe in the importance of early detection and are optimistic about the medical advancements and potential for successful cancer treatments.

The study also found that participants with higher household incomes were more likely to see a reduction in their negative beliefs about cancer, especially among those who recognised the campaign. This was presumably due to the fact that high-income individuals usually have comprehensive health insurance coverage which provides better access to healthcare resources, including regular check-ups and cancer screenings (Sharifa Ezat et al., 2023). This also could provide them a safety net in terms of healthcare costs, reducing the financial burden associated with cancer treatment. As such, lower financial stress can contribute to a more positive belief in cancer or other diseases.

The study concluded that negative beliefs about cancer and colorectal cancer (CRC) screening among the participants were significantly reduced after the campaign,

particularly among those who noticed our campaign materials. This demonstrates that the implementation of BCAC-CRC successfully achieved its objective of reducing negative beliefs about cancer and CRC screening.

5.5.3 The effectiveness of the Be Cancer Alert - colorectal cancer campaign on awareness raising for attitudes towards each colorectal cancer (CRC) symptoms among the community in Rawang, Selangor

Participants who sought medical assistance in less than two weeks if they experienced any one of the six CRC symptoms were considered to have a positive attitude. The majority of participants from this study sought medical assistance in less than two weeks if they noticed any of the six CRC symptoms. There was a reduction of about 4.7% in the proportion of participants who took more than two weeks to seek medical assistance if they experienced 'rectal bleeding' and 'persistent pain in your abdomen' after the campaign. Another study in Malaysia reported that only 6% of participants anticipated a delay in seeking medical assistance if they noticed rectal bleeding. However, this was not an intervention study (Schliemann et al., 2021). For participants who took more than two weeks to seek medical assistance if they experienced 'blood in the stool', a reduction of 3.7% (pre-campaign= 7.5%, post-campaign= 3.8%) was reported. A study conducted in Perak, Malaysia, revealed that almost 40% of participants predicted a delay in seeking medical attention if they had 'blood in the stool.' This was found to be ten times greater than the current study's findings. However, this was also not an intervention study (Su et al., 2013b).

According to this study, Indians, particularly those who recognise the campaign, are more likely to seek medical assistance compared to other ethnicities for all CRC symptoms. This also accords with findings from current research by Schliemann et al. (2021), who found that Indian participants were more likely to anticipate seeking medical

attention in the occurrence of rectal bleeding than Malay participants (Schliemann et al., 2021). In addition, the changes in attitudes towards seeking medical assistance among ethnic groups may be associated with a lack of awareness of symptoms. For example, the other ethnicities might have the poorest symptom awareness or are not confident in interpreting CRC symptoms, which most likely leads to delays in seeking care. Additionally, as pointed out earlier, the BCAC-CRC campaign reached more than half of the Indian participants through radio and print media. Therefore, it is evident that the BCAC-CRC campaign has increased their understanding and made them aware of the importance of obtaining medical attention promptly if they experience any symptoms of CRC.

Ek et al. found that women tend to be more knowledgeable than men about health issues (Ek, 2013). In line with this finding, females and more specifically campaign recognisers from our study were more likely to seek care for their CRC symptoms than males. However, it is a minimal improvement and not statistically significance. Women typically utilise healthcare services more frequently than men related to pregnancy, childcare, hormone replacement therapy, and cancer screening. Active engagement with healthcare services improves women's health-related knowledge and motivates them to engage in more preventive and protective activities, such as cancer detection, than males. However, males behave differently in preventive and help-seeking behaviour compared to females (Al-Azri et al., 2018). Numerous studies demonstrate that men are more likely to have a delay in help-seeking behaviour after the onset of any CRC symptoms (Cockburn et al., 2003; Kemppainen et al., 1993; Young et al., 2000). A systematic review of the medical records of individuals who were diagnosed with colorectal cancer in Australia revealed that there was a delay between the onset of CRC symptoms and their consultation with a healthcare professional among male patients (Young et al., 2000). The males have an assumption that they have less risk of cancer, a lack of knowledge about

symptoms, not stressing the seriousness of symptoms and they have an impression that cancer symptoms are transient. In addition, they also feel fear about cancer and don't want to appear weak or hypochondriac. All these factors may prevent men from seeking medical assistance at the appropriate time (Evans et al., 2005).

The results indicate that married campaign recognisers in this study were more likely to seek assistance than married individuals. However, this is not statistically significant. Previous research suggests that married people and those with stronger social support are more likely to seek medical attention for symptoms and participate in preventive actions (Krajc et al., 2023). A study found that married individuals are more likely to undergo CRC screening if their spouse has recently been screened. Men, in particular, are nearly twice as likely to have a colonoscopy if their wives have had one, suggesting a strong link between spousal health behaviors (Kotwal et al., 2016). Another study of 492 adults in Kentucky, USA, discovered that married individuals had significantly more positive behaviour in seeking a healthcare professional's assistance than unmarried individuals, although after adjusting for other variables, including age, gender, education level, and household income. Social support and encouragement from a partner may be the foremost in minimising the delay in seeking medical assistance for colorectal cancer symptoms (Jessica, 2018).

Our study finding was similar to a study previously conducted by Schliemann et al. (2021) in Malaysia. However, our finding was not statistically significant. Schliemann et al. (2021) reported that a greater proportion of participants with less educational attainment responded to being delayed in seeking a medical professional's assistance if they noticed rectal bleeding and breast abnormalities, compared to participants with higher educational attainment (Schliemann et al., 2021). This study provides evidence that education is linked with a positive attitude to seeking medical assistance for CRC symptoms. According to research by Marcu et al. (2016), those with lower educational

attainment are more prone to postpone seeking medical assistance when having any cancer symptoms (Marcu et al., 2016). The possible reason for this association is that those with lower levels of education might be less educated about CRC symptoms and the importance of early diagnosis. They are also less likely to undergo regular screenings or be aware of a family history of the disease. A second possible explanation is that those with lesser levels of education may have limited access to healthcare services and resources. They may struggle with navigating the healthcare system, locating inexpensive healthcare options, and capable of not understanding medical terminology and instructions.

This study discovered that even after the health campaign, there was little change in the attitude of participants, particularly those who recognised the campaign, towards seeking medical help promptly if they experienced any symptoms of colorectal cancer (CRC). It seems that a health education campaign can only enhance knowledge and belief, but it cannot ultimately change attitude. An individual must be willing and ready to accept health-related information to positively influence their attitude. Additionally, those who have self-efficacy to make positive changes in their attitude are more likely to embrace and apply health-related information in their lives. They must also perceive themselves as susceptible to health problems and understand the importance of preventive measures to adopt and maintain a positive attitude towards them. An individual must believe that the potential consequences of a health problem are severe, so they are more likely to develop a positive attitude towards preventive measures.

5.6 Strengths of this study

This research study has several strengths. It is the first study in Malaysia to use a mass-media campaign as an intervention strategy with cultural adaptation to increase awareness about colorectal cancer (CRC) and CRC screening. Additionally, the findings of a

systematic review conducted in this study suggested a need to develop a CRC mass-media awareness-raising campaign in Malaysia. In addition, this study developed an intervention and evaluated CRC awareness before and after the campaign.

Previously, CRC awareness interventions and campaigns in Malaysia were carried out for a short time, with most events lasting only one day and without appropriate evaluation. Therefore, there is a need for a culturally adapted mass-media cancer campaign tailored to the specific cultural context, beliefs, and values of the population while retaining the core elements of the original intervention that are effective in Malaysia. The "Be Cancer Alert" campaign was the first CRC awareness-raising mass-media campaign designed to adapt campaign materials for Malaysians to fill the research gap. Multidisciplinary teams, including cancer survivors, language experts, public health specialists, academics, researchers, event management, and local populations of various ethnicities, performed cultural adaptation. Their full commitment and knowledge shared throughout expert panel discussion and group discussion were the major strengths of this campaign.

The mass-media campaign was executed through TV, radio, newspapers, websites, and social media platforms, while the local campaign was implemented through print media such as billboards, buntings, posters, and brochures. Promotional materials for the campaign were created in Malay, Mandarin, and Tamil languages and distributed to the local population in their native language. Unlike previous CRC campaigns that used only one type of mass-media due to budget constraints, this campaign had proper cultural adaptation of the materials with comprehensive planning and was well executed through various mass-media.

An evaluation of the reach and effectiveness of the campaign was carried out through a household survey. The household survey is a systematic data-driven approach used to understand the current state of CRC knowledge and behaviours within a community or population. The house addresses for data collection were purchased from the Department

of Statistics Malaysia to have comprised a variety of ethnic groups and socioeconomic statuses, which contributed to the recruitment of a diverse sample of participants. A random sampling technique was used to select the participants from the study area, which reduced the effect of selection bias and significantly improved our campaign effect for generalisation due to enough sample size. Enumerators who collected data were well-trained, especially given detailed information about the campaign and questionnaires.

The validated questionnaires, Colorectal Cancer Awareness Measure and Awareness and Belief about Cancer are beneficial for assessing the effectiveness of the campaign in terms of improvement of knowledge, beliefs, and attitudes on CRC and CRC screening. The pre-campaign household survey on knowledge, beliefs, and attitudes about CRC and CRC screening in Malaysia provided insightful data regarding their knowledge and perspective regarding CRC and screening. The pre-and post-campaign study design allowed us to capture the changes in their knowledge, beliefs, and attitudes towards CRC and CRC screening.

5.7 Limitations of this study

This study could not conduct a pilot test on the final campaign materials to get feedback from the community on their readability, understandability, and cultural acceptability. The selection of channels for mass-media was based on local community discussions, but a pilot study would have been better to identify the specific television and radio channels that have a broad reach to the population. The study's research fund could not subscribe to Astro due to high broadcasting fees, which made it difficult to reach more Indians and Chinese populations. In Malaysia, public places such as libraries, bus stops, and public toilets were not the preferred places to distribute campaign materials, unlike in western countries. Even highly frequented public places like mosques,

temples, and churches pose challenges for distributing brochures and displaying posters due to cultural restrictions.

A randomised controlled trial is the ideal study design to assess the effectiveness of an intervention. However, the study could only conduct a pragmatic comparison between pre- and post-interventional data collection. The study could not have a control group that was not exposed to the campaign due to the nationwide aspect of the mass-media campaign (TV and radio).

This study utilised a social media campaign on Facebook and Instagram influencers in Malaysia, but no evaluation was made on the effectiveness of the social media campaign. Instead of mass media channels, future studies should create an extensive social media campaign with an evaluation, as social media has become one of the main information-seeking platforms. This underscores the urgency of transforming medical education, and we are pleased to feature researchers who have explored social media campaigns, evaluated their effectiveness, and embraced the digitalisation of medical education.

This study relied on a social media campaign on Facebook and sporadic Instagram influencer posts in Malaysia, lacking an evaluation of its effectiveness. Future endeavours, spearheaded by entities like the Ministry of Health (MOH) or non-governmental organisations, should prioritise creating comprehensive social media campaigns coupled with thorough evaluations. The COVID-19 pandemic has prompted a shift in information-seeking behaviours towards social media, surpassing traditional platforms like television, radio, newspapers, and magazines. This shift emphasises the need for a transformation in medical education. Consequently, we're enthusiastic about featuring researchers delving into social media campaigns, their evaluation, and the digitalisation of medical education.

It is possible that the campaign's low reach is due to a lack of participation from the Chinese population. This may be because of language barriers encountered during data

collection. The survey instrument used only English and Malay questionnaires, which created difficulties for participants in understanding the questions and expressing their experiences and opinions in a language that is not their native tongue. Furthermore, most Chinese participants are not proficient in English or Malay, and the study enumerators are unable to communicate in Mandarin, Hokkien, and Cantonese.

This study lacks comprehensive evaluation in cost-effectiveness of the culturally adapted mass media campaign. Although the campaign successfully promoted awareness of CRC, its financial efficiency remains unclear. This is because the cost of media production and dissemination as well as the potential reduction in healthcare expenditure through early detection and prevention were not adequately measured. Future research should consider incorporating a cost-benefit analysis to assess whether the resources allocated for the campaign yielded proportional benefits in terms of awareness, behavior change, and cancer screening uptake.

CHAPTER 6: CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction of the chapter

This section summarises the main findings of each study objective regarding colorectal cancer (CRC), followed by recommendations for future implementation of CRC awareness campaigns. The key message of the campaign highlights the significance of early detection. Additionally, recommendations for future research are included to address the knowledge gap in the early detection of CRC in Malaysia. These recommendations serve as the foundation for public health recommendations and future research.

6.2 Conclusion

The purpose of this study is to address the gaps in knowledge, attitudes, and beliefs about colorectal cancer and screening among different ethnic groups in Malaysia. The study strives to recommend the most effective strategy for increasing CRC awareness as there is a lack of culturally appropriate mass-media interventions that have been evaluated.

In the first phase of this study, a detailed systematic review was conducted to explore the gaps in the awareness of colorectal cancer symptoms and barriers to screening among Malaysians. The findings show that there is a lack of understanding and knowledge about the early symptoms of colorectal cancer and barriers to screening. Thus, there is an urgent need for an education campaign on knowledge about colorectal cancer and screening in Malaysia. It is recommended that community organisations and the healthcare system collaborate to enhance knowledge regarding colorectal cancer symptoms and overcome barriers to screening. The ultimate goal of this programme is to increase participation in cancer screening.

In the second phase, a culturally adapted colorectal cancer awareness mass-media campaign was explicitly developed, validated, and implemented for the Malaysian population. The campaign's main focus was to increase awareness (knowledge, attitude, and beliefs) about colorectal cancer and screening (belief and experience). This approach demonstrates the advantages of implementing a systematic and theoretically informed strategy for cultural adaptation as the most effective evidence-based public health intervention. The process comprises various strategies and challenges that provide valuable insights and recommendations for public health officers and non-governmental organisations (NGOs) regarding the planning and implementing of future campaigns in Malaysia.

The third phase of this study examined the effectiveness of a campaign aimed at increasing awareness of colorectal cancer (CRC) among the population in Rawang. The campaign was found to be successful in reaching the community, with television advertisements and printed materials being the most recognised media. The campaign materials were also considered culturally appropriate, relevant, and thought-provoking. However, they were more widely recognised among the Malay ethnicity compared to the Indian and Chinese populations.

Participants aged 50-59 and those with tertiary and secondary education were more likely to be reached by the campaign. After the campaign, participants showed an improvement in their knowledge of CRC, a minimal reduction in negative cancer beliefs and a minimal improvement in help-seeking behaviour, especially among those who noticed the campaign materials. The campaign successfully achieved its objective of increasing knowledge, reducing negative beliefs about CRC and cancer screening and improving help-seeking behaviour.

Factors that were significantly associated with an improvement in knowledge about CRC symptoms and risk factors included Chinese ethnicity, participants with tertiary and

secondary education, those who had friends and family with a history of CRC, and recognition of the BCAC-CRC campaign. As for the reduction in negative beliefs about cancer, factors that were significantly associated included participants aged 50-59, Indian ethnicity, single participants, those with a household income of more than RM 10 000, and recognition of the BCAC-CRC campaign.

Unfortunately, the campaign only minimally changed participants' attitudes and help-seeking behaviour, especially in seeking timely medical assistance upon noticing any CRC symptoms.

In conclusion, the adapted, developed, and validated CRC mass-media campaign was found to be culturally acceptable, appropriate, and reliable among the populations from different ethnic groups in Rawang. The campaign successfully increased awareness (knowledge and beliefs) about CRC, screening (belief and experience) and attitude in help-seeking behavior among the Rawang population. Even though the campaign resulted in minimal changes, there is still the possibility that an individual will undergo screening, which will lead to early diagnosis, benefit the success of early treatment, and improve their quality of life.

6.3 Recommendation

This study recommends the adoption of our comprehensively developed and validated campaign materials for any future studies related to the colorectal cancer campaign. We have received positive feedback on the campaign materials from local communities. However, for studies related to other cancer campaigns with a cultural sensitivity element, future researchers should collaborate with relevant stakeholders such as healthcare professionals, cancer survivors, cancer advocates, language experts, media personalities, media content experts, and local communities representing all ethnicities. They can

provide input on the campaign material's content, medical accuracy, appropriate language, and cultural sensitivity.

For such studies, a pilot study is necessary to obtain feedback from the community on the campaign materials' cultural acceptability, readability, and identification of specific media channels with a broad reach to the population. Researchers should aim for mass-media campaigns to reach the entire Malaysian population using various media channels like TV, radio, and printed materials in public places. Astro channels are ideal for such campaigns as they can reach a wider ethnic population. Printed materials should be available in different languages, and distributed in various public places, including religious places where the religious head should receive comprehensive information on the importance of health-related information dissemination.

One point to consider is that the campaign did not reach the elderly population (60 years and above). The poor reach among them can be attributed to physical difficulties associated with ageing, such as poor eyesight, hearing, and memory, which can hinder older people's engagement with campaign materials. Therefore, future campaigns need to carefully consider the design of campaign materials tailored to their unique needs, limitations, and preferences. These materials should be designed with a user-friendly interface, including simplicity, clear and large fonts, high-contrast colours, and intuitive navigation.

The effectiveness of a short-term campaign aimed at improving knowledge of CRC, reducing negative beliefs, and promoting positive healthcare-seeking behaviour among the public can be short-lived. As a result, it is recommended that the Ministry of Health (MOH) take a continuous and sustainable approach to CRC mass-media campaigns to improve survival and reduce the mortality rate among CRC patients.

However, a health-related campaign may not be effective if individuals have poor information-seeking behaviour. To address this, the MOH or any non-governmental

organisation must make additional efforts to raise public awareness about information-seeking behaviour, tailored to suit the specific needs of vulnerable populations such as rural communities and people with disabilities with limited access to information.

Moreover, it is suggested that educational and healthcare environments promote a culture of inquiry and curiosity, motivating people to challenge assumptions and actively seek out information to make informed decisions. Improving this behaviour could have a more significant impact on raising awareness, as more people will be eager to seek health-related information.

To improve the public's attitude towards seeking medical assistance for colorectal cancer symptoms, healthcare providers, including primary care physicians and specialists, should openly discuss and explain potential colorectal cancer symptoms with patients. Healthcare providers should also encourage individuals to assess their personal risk factors for colorectal cancer, such as family history or personal health history, and provide guidance on when to seek medical attention based on their risk profile. Additionally, healthcare providers are recommended to emphasise the importance of early detection and regular screenings. Offering telemedicine services to allow individuals to consult with healthcare professionals from the comfort of their own homes can reduce barriers to accessing healthcare.

During data collection, future researchers are recommended to prepare study instrument in multi-languages especially in Tamil and Chinese. This will help participants to articulate their thoughts, opinions, or experiences accurately in a language they are proficient. Additionally, it is also recommended to have enumerators who are fluent in at least one additional language, preferably multiple dialects in Chinese (Mandarin, Hokkien, or Cantonese), in addition to English and Malay. This will assist in recruiting more Chinese respondents to participate in the survey.

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