Reducing delay and increasing access to early diagnosis for colorectal cancer

Final Report

2021

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hrc Health Research Council of New Zealand

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

FINAL REPORT

Reducing delay and increasing access to early diagnosis for colorectal cancer

Health Research Council Reference: (HRC 17/417)

The University of Waikato

Prepared for:

Health Research Council

Prepared by:

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Date: February 2021

MESSAGE FROM THE PRINCIPAL INVESTIGATORS

Bowel cancer is one of the most important causes of cancer death in New Zealand (NZ). We have both a very high incidence of bowel cancer and also poor outcomes compared to other high income countries. Much of the cause of our poor performance is that NZ patients with bowel cancer tend to present with more advanced disease. The cause of late diagnosis of bowel cancer is not well documented. The PIPER project showed that 35% of patients with newly diagnosed bowel cancer had presented to the emergency department rather than through their general practitioner, and for Māori this was nearer 50%. Research from overseas has shown that delays in bowel cancer diagnosis can be due to patient factors, tumour factors, or system problems. DHBs have focused strongly on improving the hospital system through the faster cancer treatment pathway after a patient's referral into the hospital from primary care. Our project has focused on the patient pathway from the development of symptoms to referral by their general practitioner into the hospital system and how DHBs handle those GP referrals.

I would like to thank all the patients that have participated in this project and the staff at Waikato, Lakes and Tairawhiti District Health Boards that have given their time and expertise in supporting this study. I would like to recognise the contribution to cancer services in general that our colleagues in the Midland Cancer Network have made and wish them well in their new role with the National Cancer Agency. I would like to thank our analyst colleagues, particularly Sheena and Lucia Moosa for their help with the e-referral and Midland Cancer data. We would also like to thank our community colleagues, Hei Pa Harakeke, the Waikato Bay of Plenty Cancer Society, and Bowel Cancer New Zealand.

Finally of course I would like to thank all my co-investigators and staff on this project and the Health Research Council (HRC) for supporting this study. We hope you find this report informative and that our recommendations will help improve the pathways for bowel cancer in the future.

Sincerely,

Professor Ross Lawrenson

STRUCTURE

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He Whakanui

E mihi aroha teenei ki te iwi kai tautoko o teenei kaupapa te mate pukupuku naa raatou i homai aa raatou waa watea kia tuu atuatu aa raatou hikoi ki aa raatou mate pukupuku, Ko too maatou hiahia e whakanui eenei tangata e awhinatia maatou i aa raatou koorero i teenei purongo, ko tetehi tangata e tino whakanui maatou ko Barry Smith ki oona awhi, ki oona koorero hoki.

Noreira he tino mihi aroha teenei ki a raatou i wehe ki tua o te arai ko Barry Smith tetehi i mate i te waa haere o teenei hikoi kaa heke ngaa roimata, kaa hotuhotu te manawa e kore taatau e wareware e ora tonu koutou i to koutou koorerorero i waihotia, e hapai nei kia raatou e whai ake ana, naa te Atua e tiaki e manaaki Paimarire

We humbly would like to thank and acknowledge all those who supported this journey / kaupapa and who gave generously of their time and shared their korero / stories with us therefore giving this report the emphasis and mana deserving of their contribution I would like to also thank one individual (Barry Smith) who gave so much of his time and himself who has sadly passed on, as have others who began this journey with us to you say seek your place among the stars let the tears flow and the heart ache for you all hence you will not be forgotten your stories live on left to benefit the next generation who follow on God bless and keep you Peace.

EXECUTIVE SUMMARY

Reducing delay and increasing access to early diagnosis for colorectal cancer

This project came from a researcher initiated project grant from the Health Research Council of New Zealand.

Project Partners

Ethical Approval was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156).

University of Auckland

University of Otago

University of Melbourne

University of Edinburgh

Key results

Patients identified by general practitioners (GPs) as having a high suspicion of colorectal cancer had a 9% chance of having an underlying colorectal cancer

Raised platelet count, in addition to iron deficiency anaemia is predictive of an underlying colorectal cancer

There is a need to increase public awareness of the signs and symptoms of colorectal cancer: alarm or abnormal symptoms facilitate help-seeking, but symptoms considered as 'normal' by patients, such as constipation, do not

The patient-GP relationship and the role of the GP is critical to patients in the diagnostic process

Māori patients experience greater diagnostic delay

Māori patients are less likely to receive a colonoscopy

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1. BACKGROUND

Colorectal Cancer in NZ

New Zealand (NZ) has one of the highest incidence rates of colorectal cancer (CRC) in the world. Five-year survival for NZ patients with CRC are significantly (5%) lower than that in Australia [1]. NZ men are slightly more likely to develop CRC than women, at 53% vs. 47%, respectively [2, 3]. Māori are 30% less likely to be diagnosed with CRC but their mortality rates are only slightly lower than NZ Europeans [4]. Survival from CRC is linked to cancer stage at diagnosis, with stage 1-2 disease being eminently curable whilst survival in patients with stage 3-4 disease is poor. By international standards, NZ has a low rate of early stage CRC diagnosis [5].

The HRC funded PIPER project (11/764), completed in 2015 was the most comprehensive public and private dataset ever compiled on diagnosed CRC in NZ. The PIPER study evidenced the areas of greatest need in NZ CRC post-diagnosis. They identified that over one-third of patients with colon cancer in NZ receive their diagnosis after presentation of symptoms to the emergency department (ED) [6]. This compares poorly to the United Kingdom (UK) where approximately 20% of patients presented though a similar route [7]. NZ patients are also more likely to present with stage IV/metastatic (advanced and non-curable) colon and rectal cancers at diagnosis than their counterparts in the UK and Australia. Worse still, the proportion of Māori and Pacific patients who present via ED and who have metastatic CRC at diagnosis is much higher than for NZ European (Māori: 31.6%, Pacific: 34.9%, non-Māori/non-Pacific: 22.8%).These inequities have a considerable and disproportionate impact on poor outcomes.

The reasons why such a high proportion of patients present via ED are unknown. Presentation via ED is associated with poorer outcomes, and is likely to reflect barriers to diagnosis. Uncovering the reasons for this represents a major knowledge gap and a priority for improving outcomes from CRC in all New Zealanders (NZers), but particularly for Māori and Pacific NZers.

While PIPER is an important study on the outcomes of patients post CRC diagnosis, it also highlighted the need for improved understanding of patient and health system delays prior to a CRC diagnosis.

Māori equity

Disparities in cancer outcomes have been reported between ethnic groups in NZ, with poorer outcomes reported for Māori and Pacific populations. In Māori, CRC is the fourth most commonly registered cancer and fourth most common cause of cancer-related death, with 166 registrations and 79 deaths in 2013. The age-standardised registration and mortality rates for CRC are lower in Māori than in non-Māori in both sexes. However, while for non-Māori there has been a clear downward trend in the mortality rate over the last 10 years, this improvement has not occurred in Māori. It is important to identify factors influencing these trends to inhibit further discrepancies between the ethnic groups before further inequalities in outcome arise. A detailed review of Māori and non-Māori cancer trends is provided by the Unequal Impact: Māori and non-Māori Cancer Statistics 1996-2001 report [4]. The report agrees that non-Māori are more likely to be diagnosed with CRC than Māori, however, once diagnosed, Māori are more likely to die of the disease. This disparity is partially explained by significant differences in stage at diagnosis, however within stage comparisons survival disparities are still seen, and the report suggests that reasons for these disparities need to be investigated, with a focus on treatment pathways. An audit of CRC management with Māori patients was undertaken by Hill et al. in

301 Māori and 328 randomly selected non-Māori patients diagnosed with CRC between 1996 and 2003. They found that despite adjusting for disease variables (such as stage at diagnosis) and patient characteristics (such as co-morbidities), Māori patients were less likely to receive chemotherapy for stage III disease and if they did receive chemotherapy were more likely to wait for at least 8 weeks prior to treatment beginning [8].

Rural equity

Hill et al. suggested that urban/rural disparities in access to hospitals with cancer centres are likely to have major impact on Māori /non-Māori disparities [8]. In NZ, 16% of the population live in rural areas. Inequalities arising from urban versus rural residence have been reported internationally in a variety of diseases, including cancer. A report from the Ministry of Health "Unequal Impact II: Māori and Non-Māori Cancer Statistics by Deprivation and Rural-Urban Status" by B. Robson and G. Cormack investigated variations in cancer incidence, mortality, stage at diagnosis, and survival by rural-urban status from 2002-2006 [4]. They found that although residents of rural areas were less likely to be diagnosed with colorectal cancer, they were more likely to die of the disease. They found no significant difference in stage at diagnosis between urban and rural patients. This would suggest that there is variation occurring post diagnosis. Thus it is important to quantify any differences in patient presentation, management, treatment and follow-up between urban and rural patients, and through comparison of progression free survival, identify any differences in treatment practices and follow-up which may be affecting outcome.

Delays to diagnosis

We refer to the pre-diagnosis stage as the detection period [10], or the time period between the discovery of symptoms (or receipt of the invitation letter for bowel screening) and the medical consultation (or screening test). Aside from screening, improving access to early diagnosis is the most important step in improving stage of disease at

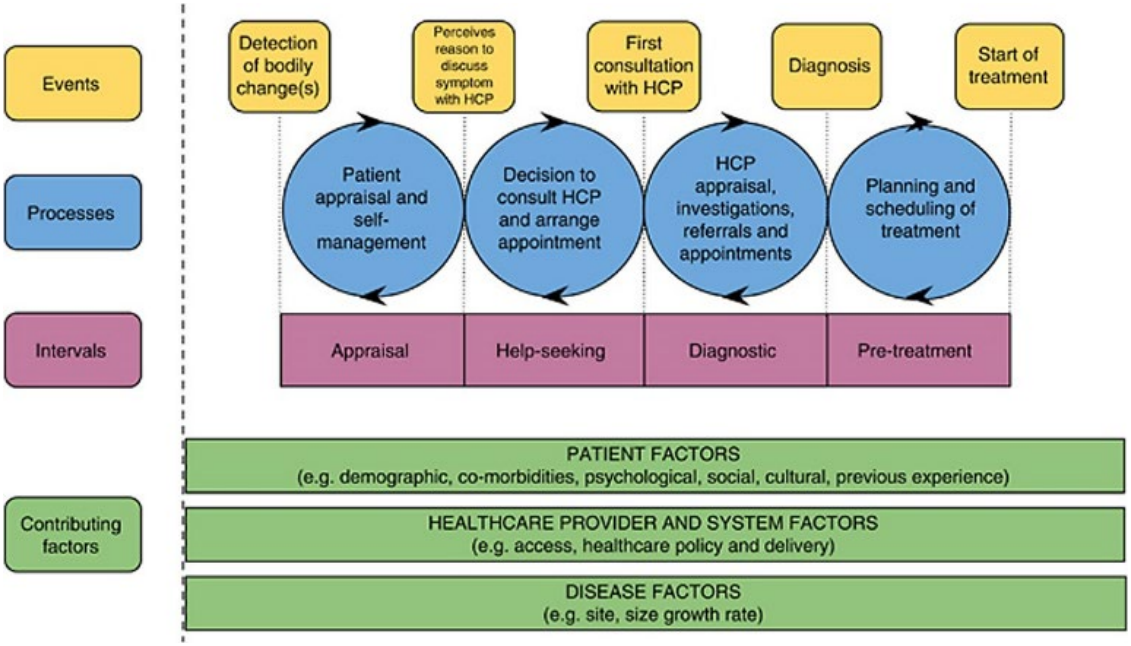


Figure 1. The Model of Pathways to Treatment [9]

diagnosis and increasing the likelihood of cure. Of increasing concern is the proportion of NZ patients presenting acutely to ED (31%) and with a bowel obstruction (19%), consistent with an unscreened population [6]. These patients generally have a poorer prognosis and are an indication of late diagnosis and variability in access to general practice. However, there is very little information about what happens to NZ patients with suspected CRC in the detection period - apart from a review of patients attending their first visit to a colorectal clinic in South Auckland [11]. Outside of the bowel screening pilot, minimal quality improvement work has been implemented to improve access to early CRC diagnosis in NZ. This is important because, although a national bowel cancer screening programme is to be rolled out, it is not anticipated to be completed until 2021, and currently only those aged 60-74 years will be eligible to take part [12]. This leaves the majority of patients still dependent on good access to diagnostics through primary care and a variable route to early diagnosis in the absence of a screening programme.

Health System/ Primary Care delays

In countries with universal first contact general practice/primary care such as NZ, Australia and the UK, primary care health practitioners, notably general practitioners (GPs), have a crucial role in facilitating earlier diagnosis of symptomatic cancers through prompt referral of suspected cancer cases [13, 14]. The UK NHS has made both awareness and early diagnosis in primary care a major part of its national cancer strategy since 2007. The National Awareness and Early Diagnosis Initiative (NAEDI) has promoted primary care research, development and service improvement. Such an approach is lacking in NZ. Key achievements of the UK NAEDI include a national primary care cancer audit, which resulted in better GP access to diagnostic tests [15]. They have also undertaken primary care research to quantify the risk of cancer when patients present with symptoms which may indicate cancer, but which may also indicate more common non-malignant conditions. This new research evidence was recently used by the National Institute for Health and Care Excellence (NICE) to update national clinical guidelines on recognition and referral for suspected cancer, which uses an explicit “risk threshold” approach [16]. The NZ Guidelines Group have established guidelines for referral in NZ, published in 2009 [17]. While some of the findings from the UK are likely to be relevant to NZ general practice, we believe that it is essential to understand the current practice in primary care in NZ.

The GP plays a significant role in the detection, management and on-going care of CRC patients over the course of their cancer journey. Patients rely on GPs for early diagnosis, referral, information and survivorship care, including psychosocial support. The Health and Disability Commissioner (HDC) Report on “Delayed Diagnosis of cancer in primary care” suggested the most common factors identified in complaints of delayed diagnosis were 'nonspecific/atypical symptoms' at presentation, a 'clinically indicated examination not conducted', 'inadequate follow-up of symptoms' and a lack of information and problems with communication [18]. Overseas studies have suggested the CRC detection period can be considerable and that the diagnostic delay may be greater for men [19-21]. An international review of delay in CRC diagnosis conducted in 2008 found that a failure to appropriately examine the patient, and receiving false negative results, were associated with delay [22]. Failures to follow-up or refer patients with iron deficiency anaemia were also significantly associated with missed opportunities for diagnosis [23]. Out of six cancers reviewed, patients with CRC were found to experience the longest diagnostic delays in primary care, a finding which has been attributed to

non-specific presenting symptoms [24]. Non-standardised primary care can contribute to large delays in management for people with cancer [25, 26]. For prostate cancer within NZ, there is significant variation in care provided by health care providers (HCPs) when it comes to cancer screening, testing and referral [27, 28]. Variability in other cancer pathways in primary care have been found by ethnicity, age and rurality [27, 29]. No similar assessment has yet been made for CRC in NZ.

Patient delay

There is a step before the patient presents to the GP. This is the interval between patient recognition of symptom onset and organising an appointment with a practitioner [24, 30-34]. Internationally, qualitative research methods have been fruitful in understanding how patients recognise possible symptoms and signs of cancer and why they make complex decisions to seek, or not to seek, health care practitioner advice [35-38]. For instance, it has been shown that patients are more likely to present late with cancer if they are registered in a practice where it is hard to get an appointment [39]. Recent research on Māori patients has indicated continuity of care with a trusted GP is needed for general practice to engage better with Māori patients [40]. Such findings have the potential to inform future interventions to reduce the time to cancer diagnosis.

This substantial gap in evidencing areas of delay in the detection period hinders the ability to implement an equity-based intervention in the detection period. A key area of delay is the interval between patient awareness of symptoms and choosing to consult a GP [30, 41, 42]. Even less is known about which facilitating factors support early diagnosis in the detection period, particularly from the patient's perspective.

A national bowel screening programme for NZ

The bowel screening programme for NZ was piloted in the Waitemata District Health Board (DHB). The pilot began in 2011 and the roll-out was extended to Hutt Valley and the Wairarapa, with other DHBs participating from 2018 onwards [10]. The eligible age range during the pilot screening programme was 50-74 years, but this has been raised to 60-74 years [10]. The 60-74 group is important as approximately 40% of CRC cancers are diagnosed in this age range [3]. However, it is critical to note that nearly one-third of patients aged less than 60 years at diagnosis have stage IV (metastatic) disease; this compares to 24% of patients in the 60-79 age group [6]. This means that while the younger age group (<60 years) has a lower incidence, they have a higher likelihood of having an incurable CRC diagnosis as soon as their cancer is found. The incidence of CRC in those <50 is also rising [43].

For the national bowel screening programme to have a successful impact on lowering disease stage at diagnosis, the participation rate of eligible patients needs to be high and there needs to be timely access to diagnostics. International rates of participation in CRC screening vary considerably - from 7% in Belgium (Brussels & Wallonia) to 67.7% in Finland (national). Countries most comparable to NZ varied - from Australia (33.1%), Canada (regional variation 23.2% - 34.1%) to England (52.4%) [44]. Equitable engagement within the screening population is also of concern both nationally and internationally. Within NZ there is the potential for Māori and Pacific inequity to increase if participation by these groups in screening is undersubscribed. Internationally, low uptake rates of screening are associated with low socioeconomic status, health literacy level, age, gender and ethnic origin [45]. The challenge of engaging Māori and Pacific patients in regular screening has been acknowledged as a significant problem with other screening programmes in NZ

e.g., cervical and breast [46, 47] and has highlighted the continuing disparity and inequity in access to, and relevance of health care programmes for, these groups [48]. Access to timely diagnostics is also still uncertain, particularly for those in rural and remote areas – of which, a large proportion will be Māori. Regardless of the screening programme, nearly 60% of patients diagnosed with CRC are outside of the eligible age range [2] and the need to ensure that these individuals have equitable access to timely diagnosis is an important outcome of this research.

Impeding and facilitating factors to accessing a CRC diagnosis

A variety of factors can affect early diagnosis and referral. A facilitating event/factor makes progress of the patient more rapid within the cancer care pathway; whereas an impeding event/factor makes the progress of the patient slower. These have not been systematically researched in NZ. To achieve this, we have adopted international current best practice on the design, conduct and reporting of research studies exploring the symptomatic cancer diagnosis pathway as is recommended in the Aarhus statement [49]. One major recommendation is that research in this domain should utilise a robust theoretical framework. We have therefore chosen to use the Model of Pathways to Treatment (see Figure 1 above) [9, 50], which highlights the four key intervals to treatment as: symptom appraisal, help-seeking interval, diagnostic interval and pre-treatment interval [9, 50]. Walter et al developed this internationally recognised model for examining pathways to cancer diagnosis, which they adapted from the seminal work of Andersen et al [9, 30]. The four intervals will all be captured, although the focus of the study is on the detection period.

Awareness of cancer warning signs and symptoms by individual patients affects the time between the development of symptoms and the realisation that these maybe serious and in need of investigation [51]. In some cases, this interval may be substantial [52]. The next stage is between realisation of the potential importance of the symptom/s and the actual action required in consulting a health professional. This interval is influenced by the ease with which patients can access a GP [39] and can be influenced by a number of factors – many of which are specific to a NZ setting [53]. The third interval that we intended to measure was the time from making a first appointment with an HCP to referral for diagnostic testing. Finally, the pre-treatment stage provides insight into the time interval post-diagnosis and supports our understanding of how delays in the earlier stages impact on the type of treatment offered – in particular, curative or palliative intent.

Each of the intervals in the pathway can be affected by various contributing factors. These can include patient factors (age, gender, ethnicity, previous experiences etc) and HCP and system factors (such as referral policies and guidelines). Clinical treatment effectiveness is influenced by access to, as well as, quality of cancer treatment, and is influenced by referral time (from GP to specialist), patient intervals (diagnosis and initial treatment), and treatment practices [49, 54]. It is important to note that factors that facilitate, not just impede access to an early diagnosis are also important to understand. deNooijer et al proposed the adaptation of Andersen's Model of Total Patient Delay to include events that support attention to cancer symptoms and help seeking behaviour such as the increased use of screening [55, 56]. Bairati et al utilised this for a breast cancer (screened and non-screened) population. We utilised this approach within this study to further enhance the framework for understanding barriers and enablers of early diagnosis within the detection period [10].

2. METHODOLOGY

The study was structured around investigating the prevalence of delay in the diagnosis of CRC at key decision points, with a particular focus on the patient perspective. We considered the impact of other contributing factors such as: the biological features of the cancer (histological type, grade, anatomical location); symptom presentation; age, gender and ethnicity; the characteristics of the practice (high or low referrer); commitment to continuity of care; whether agreed pathways were being followed; and, any variability within the pathway. Cancer stage was considered mainly as an outcome of this process.

Ethical Approval for all phases of the study was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156).

Systematic review

We began by conducting a systematic literature review for published studies including NZ patients and/or their data examining factors contributing to late stage at diagnosis. Both qualitative and quantitative studies were included.

CRC analysed by Cancer Network

One potential concern when conducting a study in a sample population is the need to understand how representative the sample is of NZ as a whole. Consequently, early in the study we decided to investigate the characteristics and outcomes for CRC in the four Cancer Network regions of NZ. In particular, we wished to understand whether the Midland Cancer Network region was representative. We thus obtained NZ Cancer Registry (NZCR) data from 2006-2015 and linked these data to the Mortality statistics. Data obtained from the NZCR included demographic data (age, gender, ethnicity), DHB of residence, and pathological records including site of cancer, stage and lymph node involvement.

Study one: The Detection Period - Suspected CRC (01/01/2016 to 31/12/2017)

The objective of this study was to quantify referrals of suspected CRC, investigating the sources, management and outcomes of these referrals. This was achieved through a comprehensive evaluation of all referrals to secondary care within the Midland region.

Cohort: All referrals to secondary care within the Midland Cancer Network (MCN) are undertaken as electronic referrals (e-referrals). These are all computerised and can be searched by keyword or code. We identified all e-referrals from general practice to gastroenterology and general surgery departments in Waikato and Lakes DHBs from 01/01/2015 to 31/12/2017. In Lakes DHB, the GP recording of a high suspicion of cancer (HSCan) was not present, so analyses of the two data sets were under taken separately.

Method: We audited from the e-referrals basic demographic data, (age, gender, ethnicity) and referral outcome (further investigation incl. colonoscopy, whether the patient went on to a CRC diagnosis). We expected some referrals would be sent back to their GP without further investigation. We reviewed notes from hospital records (including laboratory results) and the Midland Colorectal database.

Analysis: Analyses undertaken were based on the work by Møller et al [57] including:

1. Measurement of the total number of referrals and relating it to the at risk population, assessed by age, ethnicity, etc. and assessing variations between referral sources.

2. Investigation of the proportion of confirmed CRC diagnoses (the predictive value/practice conversion rates) amongst HSC referrals; and using the ratio of

CRC rates in HSC as a measure of 'discrimination'. By comparing the numbers of patients ultimately diagnosed with CRC through each route.

3. Discrimination value of the HSC flag and variation by patient characteristics, by health care provider and other contributing factors.

4. Assessment of the triage of GP HSC flag, and investigation of contribution to diagnostic delay.

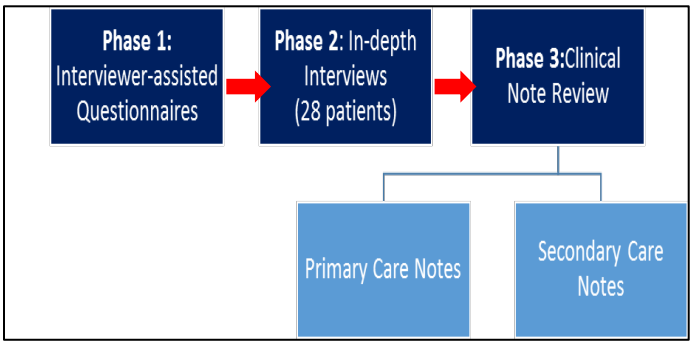
We established the level of priority assigned by the GP and then triaged by the hospital. From referrals, we were able to ascertain differences in underlying symptoms and signs, and differences in urgency by ethnicity. We also explored the investigations that were undertaken, the outcome of investigations and identified the proportion of patients who were sent back to their GP (returned by secondary care). A key part of the analysis was to measure the conversion rate i.e., the proportion of urgent referrals that result in a diagnosis of cancer by age, gender, ethnicity and GP practice.

We next explored the potential causes of delay at various points. This included identifying patient intervals from the development of symptoms, through to the recognition of the significance of symptoms to first presentation at general practice or the hospital. We looked at time intervals from first presentation through to investigation and then through to diagnosis. There is good evidence that while for many patients there is very little delay, for a proportion of patients, delay can be significant - we know that delayed diagnosis affects outcomes and it is logical that one of the biggest causes of delayed treatment is late diagnosis [6, 58, 59].

Study two: The Diagnosed Colorectal Cancer (1/07/2017-31/12/2018)

The objective of this study was to recreate the detection period for patients with a CRC diagnosis. This was achieved through three phases (Table 1):

Table 1. Study two methodological phases



1. The first phase involved interviewer-assisted questionnaires with all newly diagnosed and consenting patients. This captured the patient perspective, including their detection of bodily changes, decision to consult with family, friends, or HCP, and seek help.

2. The second phase involved in-depth interviews with two groups of purposefully selected participants, those who had experienced a delay in their pathway, and those who had not experienced a delay (met FCT pathway targeted timeframes). Neither group knew that they had been selected on this criteria.

3. The third phase was a retrospective clinical note review from diagnosis, back through primary care (and other HCP) notes. This captured the number of patient appointments and symptoms leading up to diagnosis. We also recorded all laboratory investigations and physical examination or rectal examinations where available.

Cohort: We prospectively identified all patients in the MCN (excluding BOP) with a diagnosis of CRC in from 2016 to 2019.

Study population: We recruited patients from the MCN (Waikato, Lakes and Tairawhiti DHBs). Although we intended to include Bay of Plenty (BOP) DHB, they declined to take part. Because BOP withdrew, the expected number of CRC cases recruited was less than originally hoped for.

Recruitment: Recruitment to participate in the study was started as close to confirmed diagnosis as possible. Specialist services of the relevant HCP facilitated identification and recruitment of newly diagnosed patients. MCN bowel tumour stream clinical leader (Mr Van Dalen) and Waikato DHB CRC cancer nurse specialist (Ms Warren) were developing a region-wide register of all CRC patients. This hospital-based database contains information on tumour biology, patient characteristics, patient management and treatment.

Recruitment rate: We anticipated finding approximately 670 patients with a new diagnosis of CRC during this period and (based on our previous work in prostate and breast cancer) a response rate of 65% to 80% for consenting patients. However, the number of patients recruited was adjusted to reflect BOPs withdrawal. Participation rates have been upwards of 90% on the regional registers with clinician involvement and we have had participation rates of >60% on postal surveys from HCP to patient in previous studies [60]. We worked with specialists, nurses and other health care professionals to recruit patients in the identified cohort. We introduced the study in the first instance through the clinical team then invited patients by mail and phone call. We have successfully used this method of recruitment previously [48, 60].

The first phase involved interviewer-assisted questionnaires.

Phase 1: Patient perspectives of factors facilitating and impeding access to diagnosis

The objective of this phase was to capture the patient perspective, including detection of bodily changes, decision to consult with family, friends, or HCP, and seek help. All patients were invited to undertake an interviewer-assisted questionnaire. In-depth interviews were also undertaken with a smaller number of participants (phase 2). In accordance with Wyeth et al. (2010), those Māori participants involved in the interviewer-assisted questionnaire were offered the choice of both te reo and English and were offered the opportunity to work with a Māori interviewer [61].

Method: The interviews used a questionnaire based on the Model of Pathways to Treatment (MPT) [9, 10]. We also included the SYMPTOM questionnaire as used by Walter et al [62]. Question areas included:

- patient appraisal of symptoms and self-management;
- decision to consult HCP and experiences of care received by primary and secondary care;
- first awareness and type of symptom/s;
- recognition of seriousness;
- knowledge of symptom;
- first presentation to GP;
- No. visits (primary care) before referral;
- tests undertaken;
- time to seeing a hospital specialist and diagnosis;
- perception of ease of access/ booking;
- anxiety, stress, depression;
- cognitive processing;
- emotional and physical barriers to accessing help;
- facilitators to diagnosis;
- relationship with HCP;
- discrimination;

Ensuring quality: We cross-referenced patient responses (where possible) against GP and other

HCP data to help validate these data and reduce recall bias (phase 3).

Data analysis: Questionnaires were scored and compared with the clinical note review (phase 3). To assess factors contributing to delay, we used multiple logistic regression analysis with delay as the dependent variable. Analysis also included factors related to the time interval from first symptom to GP referral.

Phase 2: Patient Semi-Structured Interviews

Purpose: To derive an in-depth understanding of the participant experience of the detection period.

Method: A total of 28 patients were recruited and interviewed. Interviews were offered in both te reo Māori and English. Interview topics covered patient experiences of health care, symptom recognition, relationship with HCP/GP, knowledge of condition, knowledge of cancer pathway and diagnosis. Delay in each of these intervals was defined as >3 months and no delay was classified as <3 months, based on a previous review [63].

Recruitment: We purposefully recruited two groups of patients, those who had been identified as experiencing a delay in their cancer pathway at the detection stage and those who had not experienced a delay.

Design: The interviews were semi-structured and recorded by dictaphone. Topics centered on understanding the patient experience of symptoms, self-management, mana motuhake, supportive care (referral and knowledge), health care engagement/barriers. Where possible, partners were encouraged to participate in the interview to further inform the research team. All interviews were recorded and transcribed.

Analysis: A thematic analysis was conducted. An initial coding framework was developed from the interviews, and descriptive codes were organised into thematic categories. Research team members independently assessed the plausibility and explanatory value of the categories against the transcripts, and also independently evaluated the assignment of a sample of the data to the categories.

Phase 3: Clinical note review across Primary Care Services

Working with primary care practices we accessed records for consenting patients. Symptom and signs of CRC have been well documented e.g., New Zealand Guidelines Group 2009, Suspected cancer in primary care: guidelines for investigation, referral and reducing ethnic disparities and Ministry of Health, Guidance on Surveillance for People at Increased Risk of Colorectal Cancer. These can be divided into patient symptoms and signs and symptoms relevant to a health professional. Patient symptoms included:

- Rectal bleeding, weight loss, changes in bowel habit (COBH), constipation, diarrhoea, abdominal pain

Signs and symptoms relevant to general practitioners included:

- Rectal bleeding
- A change in bowel habit to looser stools and/or more frequent stools
- Palpable rectal mass
- An abdominal mass
- Unexplained iron deficiency anaemia
- Any unexplained gastrointestinal symptoms and known high risk factors, for example, familial adenomatous polyposis.

We reviewed patient records identifying these key signs and symptoms and the date of first recording of symptoms and record to the GP. We reviewed the 2-year period preceding diagnosis and recorded the number of general practice contacts in the 12 months prior to diagnosis.

Analysis: We sought to validate patient-reported dates and events against GP-recorded dates and events. Data collected included the number of GP appointments within 12 months prior to diagnosis, specific CRC symptoms noted (e.g., COBH, rectal bleeding, abdominal pain, weight loss), date of first presentation to a GP with CRC symptoms, other symptoms listed, tests ordered and date of GP referral to secondary care (if applicable). Clinical date of diagnosis was validated against dates obtained from Waikato DHB clinical records where date of colonoscopy was recorded as the date of diagnosis. The number of GP contacts in the 12 months prior to diagnosis were also counted from the GP records and compared to the number of patient-reported visits.

3. RESULTS:

Why does NZ have such poor outcomes from colorectal cancer – the importance of the pre-diagnostic period

Firth, M., Blackmore, T., Chepulis, L., Keenan, R., Stokes, T., Weller, D., Emery, J., Lawrenson, R. Why does NZ have such poor outcomes from colorectal cancer – the problem of late diagnosis? 2021 Journal of Primary Health Care (In press, Journal of Primary Health Care) (see Appendix 3)

Given the relationship between disease stage at diagnosis, survival outcomes and the poor distribution of stage at diagnosis, it follows that survival post-diagnosis of CRC in NZ is poor among international comparisons, particularly when compared to Australia [1, 64, 65].

We identified and summarised research undertaken in NZ to investigate factors affecting the pre-diagnostic period for patients with CRC, and which may contribute to late stage at diagnosis and poor survival. We conducted a systematic review for published qualitative and quantitative studies between 2009 and 2019 including NZ patients and/or their data examining factors contributing to late stage at diagnosis (see Appendix 3 for full methodology and results).

Findings

Appraisal Interval

Studies examining perceptions of CRC screening identified the need to raise awareness of CRC in the public profile [66-69]. They suggested that a multiple media source campaign to raise awareness of CRC was necessary and could also address many of the perceived inhibitory factors to screening; including patient factors surrounding reticence and concern regarding ability to collect faecal specimens, and health-system factors including perceived poor test reliability. Disease factors relating to lack of specific symptoms and perceived slow development of CRC were seen by patients as positive reasons to undergo screening. In a qualitative survey by Windner et al, 95% of participants reported being symptomatic,

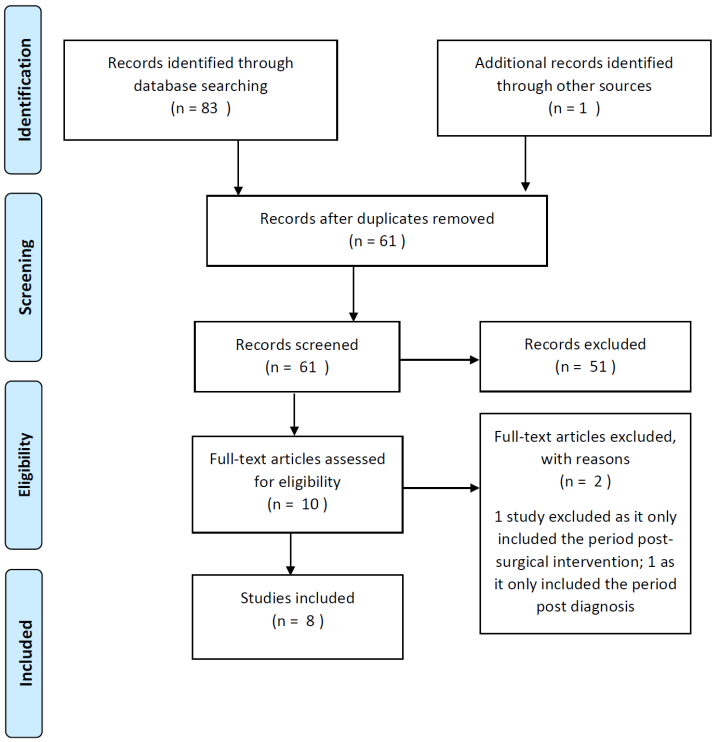


Figure 2. PRISMA 2009 diagram.

with 73% reporting more than one symptom. The most common 'trigger' symptom was rectal bleeding [70]. In considering the pathways within this interval, Windner et al [70] found that the majority of patients consulted someone who was not a health care professional (HCP), prior to consulting an HCP. The critical role of the GP in CRC diagnosis (and screening) was re-emphasised multiple times. Patients aged <50 years old were statistically significantly more likely to report delay of 6 months or longer than those in the screening programme age range of 60+ years [70].

Help-seeking Interval

Disease factors identified as facilitating help-seeking behaviour were non-specific symptom concern. Conversely, an acceptable alternative benign explanation for symptoms was the most commonly

identified inhibitory factor. Raising public awareness of CRC as discussed in the appraisal interval above would likely also have an impact on the help-seeking interval, as would the role and relationship with the GP.

Diagnostic Interval

Windner et al reported 54% of participants had 0-1 and 6% had 4 or more visits with their health care provider (HCP) prior to diagnosis. Tiong et al compared their cohort to national and international targets for wait-times between referral to colonoscopy and referral to first treatment, and found that 44% and 21% met the 42 day and 62 day targets respectively. They also identified an increased pre-hospital delay (symptom onset to first specialist appointment (FSA)) for patients with systemic symptoms and altered bowel habit [71].

Discussion

Limited research has been undertaken in NZ patients diagnosed with CRC to examine the pre-diagnostic period and the effects of variations in the pre-diagnostic period on late diagnosis. The majority of available studies are nearly 10 years old. The studies repeatedly highlighted the need for increased public awareness of CRC in NZ to assist self-appraisal, help-seeking and screening participation. They also emphasised the fundamental role GPs and primary health play in a CRC diagnosis and in facilitating screening. Qualitative studies demonstrated a failure to meet national and international targets for timeliness, particularly when looking at the period from referral to FSA, diagnosis or treatment; although delays were not shown to be associated with late-stage diagnosis. Plenty of gaps exist in our understanding of patient, health care provider/system and disease factors that facilitate or inhibit the pathway to diagnosis for patients diagnosed with CRC in NZ. We have also highlighted the lack of information on Māori and Pacific populations, who have poorer outcomes.

Many factors influencing the pre-diagnostic pathway are likely to be population and health-system-specific. A 2014 NZ study surveyed 192 GPs in regard to a range of cancer types and found that NZ GPs have poor access to colonoscopy compared to other countries (all considered to have similar, primary-care led health services to NZ e.g., Australia, UK) [72]. This work also suggested that NZ GPs are less likely to refer patients at risk of colorectal cancer, although could not address why this may be. Perhaps poorer access to colonoscopy means that GPs are more reluctant to refer and apply a higher threshold before referring for colonoscopy. We argue that it is imperative to support and facilitate GPs in the CRC pre-diagnostic pathway more effectively, through improving our knowledge and understanding of the current inhibitory factors that exist, implementing evidence-based changes to mitigate these factors and improve timely diagnosis for all patients.

Perceived delay in CRC diagnosis is of importance to the NZ patient. The 2015 Health and Disability Commissioner (HDC) report on delayed diagnosis of cancer in primary care indicated that delays in diagnosing CRC were one of the biggest causes of complaint, and over-represented when compared to its incidence in the population [18]. Perhaps the most worrying finding of the report is that the total number of cancer complaints made to the HDC over the 10 year period had significantly increased from 2004 to 2013 [18]. Although this report is now 6 years old, it is likely that similar issues still exist, as described in a 2019 article from the Associate Commissioner Jane King in NZ Doctor, describing a case seen four times over a nine-month period, initially for perianal itch and irritation, progressing to rectal bleeding and change in bowel habit [73]. Clear pathways and interventions, based on a knowledge of facilitatory and inhibitory factors to diagnosis, along with adequate support and prompt and appropriate follow-through from the secondary care

sector are needed to support the primary sector in this crucial role.

We found a paucity of recent data examining the pre-diagnostic period for patients in NZ diagnosed with CRC. Given the known poor distribution of stage at diagnosis and survival outcomes by international comparisons, inequities in stage at diagnosis and survival outcomes by ethnicity, limitations of the current screening programme, differing age distributions for Māori and Pacific populations, and increasing rates of CRC diagnosis at younger ages; we concluded it is imperative that we seek to understand how we can improve stage at diagnosis, via thorough examination of the pre-diagnostic pathway and implementation of facilitatory factors. Work to date highlights the critical role of the GP in this pathway, and the need for carefully designed and evaluated public awareness campaigns for CRC.

The characteristics and outcomes of patients with colorectal cancer in New Zealand, analysed by Cancer Network

Blackmore, T., Lao, C., Chepulis, L., Page, B. and Lawrenson, R. The characteristics and outcomes of patients with colorectal cancer in New Zealand, analysed by Cancer Network. New Zealand Medical Journal, 2020, Vol 133, No. 1513, pp. 42-52 (see Appendix 4)

NZ is divided into four regional cancer networks: the Northern, Midland, Central and Southern Cancer Networks. Within these regional networks are several DHBs that provide for the health needs of the local population: the Northern Cancer Network covers the Northland, Auckland, Counties Manukau and Waitemata DHBs, the Midland Cancer Network covers Waikato, Lakes, Bay of Plenty and Tairawhiti, and the Central Cancer Network encompasses Taranaki, Whanganui, MidCentral, Hawke's Bay, Wairarapa, Hutt Valley and Capital and Coast DHBs. The Southern Cancer Network encompasses the whole of the South Island. We aimed to quantify the outcomes of patients diagnosed with CRC in NZ using national databases across these four regional networks.

We retrospectively reviewed patients diagnosed with CRC (ICD-10-AM codes C18–C20) between 01 January 2006 and 31 December 2015. Patient and tumour characteristics were compared between the four cancer networks (refer to Appendix 4 for full methodology and results).

Results

In the 10-year period, 2006–2015, 29,221 people were diagnosed with CRC (see Table 1 in Appendix 4). The observed regional difference in survival was greater in patients under 75 years than in patients aged 75 years or older (see Figure 3). Patients aged less than 75 years in the Northern Cancer Network had the best survival: five-year cancer-specific survival of 69.2% (67.7–70.6%) and five-year all-cause survival of 64.9% (63.4–66.3%); while their counterparts in the Midland Cancer Network had the worst survival: five-year cancer-specific survival of 62.9% (61.0–64.8%) and five-year all-cause survival of 58.3% (56.4–60.2%). Cancer-specific survival and all-cause survival improved over time for both patients under 75 years and patients aged 75 years or older, after adjustment for other factors (see Tables 2 and 3 in Appendix 4). The risk of dying of CRC and the risk of dying from other causes both increased with age. Men under 75 years were more likely to die of CRC compared to women, but men aged 75 years or older had a similar risk. For patients

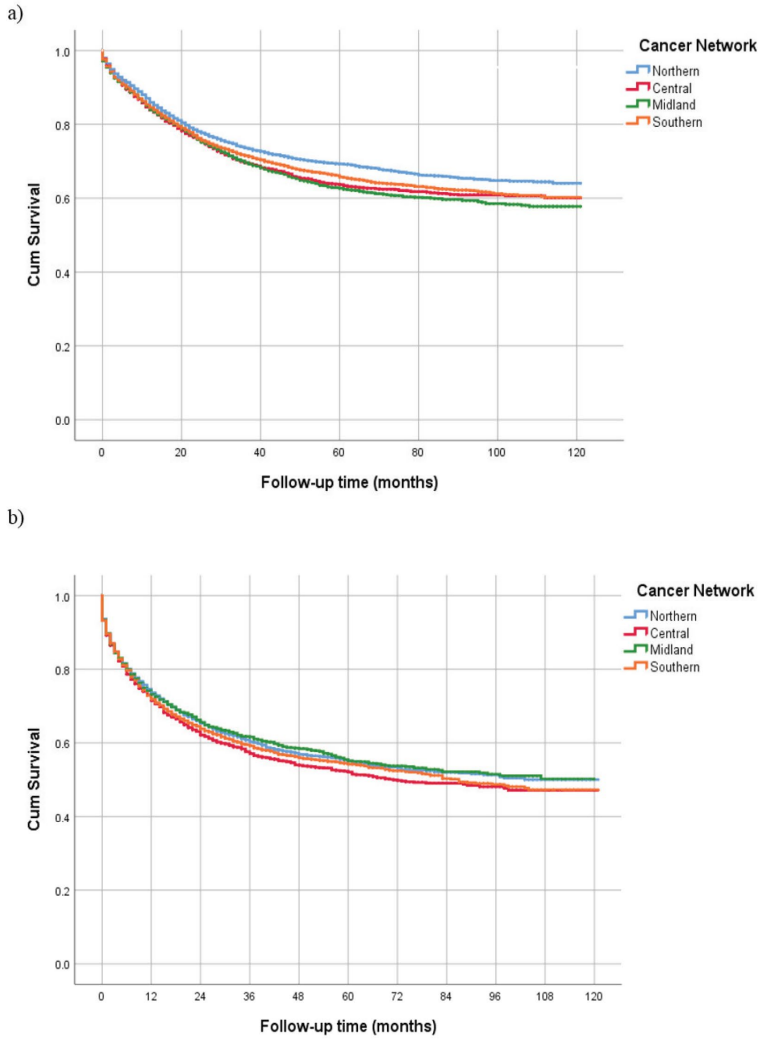


Figure 3. Colorectal cancer-specific survival by cancer network: (a) <75 years (p=0.000); (b) ≥75 years (p=0.005).

aged under 75 years, Māori had the highest hazard ratio of cancer-specific mortality (1.30, 95% CI: 1.18–1.43) and the highest hazard ratio of all-cause mortality (1.41, 95% CI: 1.30–1.54) compared to NZ European (see Table 2 in Appendix 4). However, for patients age 75 years or older, Pacific patients had the highest hazard ratio of cancer-specific mortality (1.35, 95% CI: 1.04–1.75) and the highest hazard ratio of all-cause mortality (1.32, 95% CI: 1.04–1.66) compared to NZ European (see Table 3 in Appendix 4).

After adjustment in a multivariate analysis for other factors (see Tables 2 and 3 in Appendix 4) the differences in the cancer-specific mortality and all-cause mortality for patients aged less than 75 years between the four cancer networks disappeared. However, for patients aged 75 years or older, those resident in the Central and Midland Cancer Network had a higher risk of dying of CRC compared to patients in the Northern Cancer Network (1.12, 95% CI:1.03–1.22 and 1.10, 95% CI: 1.02–1.18 respectively). For both cancer-specific mortality and all-cause mortality for patients under 75 years and patients aged 75 years or older, the risk was higher in patients with colon cancer, patients with more extensive cancer, patients with higher grade of cancer and patients with positive lymph nodes. Māori and Pacific patients <75 had worse all-cause and cancer-specific survival than NZ European. Of interest was the finding that in the over 75 year age group, while Pacific patients had poorer survival (OR 1.35) compared with NZ European, outcomes for Māori were similar (OR 1.06).

Discussion

Cancer-specific and all-cause mortality increased with age. Patients aged <75 and living in the Northern Cancer Network had the best five-year all cause and cancer-specific survival, and patients living in the Midland Cancer Network had the worst. However, after adjustment for patient and tumour related factors these regional variations were no longer important. One important factor was that although Māori only account for 5.4% of cases, outcomes for Māori are poor, with an unadjusted HR for cancer-specific survival of 1.3 and all-cause survival of 1.41 in patients <75. The Midland region had the highest proportion of Māori and this may account for some of the disparity in outcomes. Another factor was tumour characteristics. The Midland region also had a greater proportion of colon cases. Cancer-specific outcomes for rectal cancer were 20% better than outcomes for colon cancer. Thus after adjustment for a number of patient and tumour factors, including ethnicity and tumour location, we can see that the impact of the health services in each region seems to result in equitable outcomes, especially for those <75.

Conclusions

No regional variations were seen within NZ for the characteristics and survival outcomes of patients <75 diagnosed with CRC. However the risk of dying from CRC increased for those >75, which is supportive of the international literature regarding outcomes for elderly patients. We continue to show disparity in outcomes for Māori and Pacific patients diagnosed with CRC in NZ.

Study one: The Detection Period – suspected CRC

E-referrals from general practice

General practitioners (GPs) play a significant role in the detection, management and on-going care of CRC patients over the course of their cancer journey. Patients rely on GPs for early diagnosis, referral, information and survivorship care, including psychosocial support. GPs are encouraged to identify patients at high risk of cancer to ensure they are seen swiftly and diagnosis is expedited quickly. The "faster cancer treatment" guidelines require that 85% of patients receive their first cancer treatment (or other management) within 62 days of being referred with a high suspicion of cancer, increasing to 90% by June 2017 [74]. The target covers patients referred when there is a high suspicion of cancer and the hospital doctor receiving the referral believes there is a need for an appointment within two weeks. A study of GPs in NZ found that 66% were aware of NZ guidelines for cancer in primary care, and 40% of GPs consulted them sometimes or often [72]. Another study found that 24% of surgical referrals by GPs are for cancer concerns [75].

GPs in the Waikato region use an e-referral process. While generally all referrals are reviewed to see whether they will be offered as First Specialist Assessment (FSA), since 2016 for patients who have clear cut symptoms and are in the appropriate age range, GPs in the region have been able to make a direct referral for colonoscopy. However, these patients also require the approval of a specialist before a colonoscopy is arranged. Waikato DHB has 75 general practices and referral rates between practices vary greatly. It has been postulated that there is a correlation between referral rates and the risk of underlying pathology e.g., high referrers may have a lower positivity rate. It has been noted in the UK that using routine data on detection and conversion rates of different GPs should be interpreted with caution and is altered by the case mix of patients presenting [76].

Our focus was on the diagnosis of CRC so we were interested in the e-referral pathway for CRC patients, particularly the GPs' use of the High Suspicion of Cancer (HSCan) label at time of referral.

Methods

We retrospectively reviewed secondary data sourced from the electronic patient management system (iPM) from Waikato DHB matched to data from the National Cancer Register through Midland Health Network. National Health Index (NHI) was used to link the patients in the two data sources. We identified all e-referrals from GPs to General Surgery and Gastroenterology at Waikato DHB from 2015-2017 by age, gender, prioritised ethnicity and GP surgery of the WDHB region. We also extracted data on the acceptance of the e-referral, GP label of high suspicion of cancer (HSCan) and the hospital label of HSCan after triage of the referral. We followed the cohort for two years (2017 data was followed only for a year) to identify new cases of cancer, including CRC.

For the analysis we constructed patient level data from the e-referrals using the NHI. Data was cleaned and error records and duplicates removed during data extraction. Since some patients had more than one e-referral, in determining the date of referral, demographic parameters and GP surgery, we used the details recorded at the first referral. Similarly, if any of the e-referrals for the patient during the period was accepted, had a GP HSCan label, hospital HSCan label we treated as the patient as having the said parameter.

Results

Patients referred by GPs were generally in the younger (30-49 years) or 70+ age groups, female and non- Māori (see Table 2).

Table 2. Patient characteristics: all e-referrals (N=20648).

		Frequency	Percent
Age group	30-49	5659	27.4
	50-59	4210	20.4
	60-69	4672	22.6
	>=70	6107	29.6
Sex	Male	9375	45.4
	Female	11273	54.6
Ethnicity	non-Māori	17803	86.2
	Māori	2845	13.8

We can see that as patients age they are slightly more likely to be accepted for assessment in the hospital, but there are no real differences in acceptance rates for men or women or for Māori compared with non-Māori (see Table 3). We were also interested in knowing if practices who referred more patients in (and presumably therefore had a lower threshold for referral) were more or less likely to have their patients accepted by the hospital. We found no difference in the acceptance rates between low and high referring practices.

We noted that where the GP had indicated a high suspicion of cancer 88.5% of patients were accepted to be seen compared with only 81.8% if there was no HSCan label (see Table 4).

In a multivariate analysis, the significant variables as to whether a patient was accepted or not were age, whether the patient had documented symptoms and whether they had been labelled as having a high suspicion of cancer by their GP.

Table 3. Characteristics of patients accepted for assessment by Waikato DHB after referral by GPs with and without the HSCan label.

Characteristics		Labelled HSCan		Not labelled HSCan		Overall
Age group	30-49	1134	20.0%	4525	80.0%	5659
	50-59	745	17.7%	3465	82.3%	4210
	60-69	787	16.8%	3885	83.2%	4672
	70+	1009	16.5%	5098	83.5%	6107
Gender	Female	2039	18.1%	9234	81.9%	11273
	Male	1636	17.5%	7739	82.5%	9375
Ethnicity	non-Māori	3186	17.9%	14617	82.1%	17803
	Māori	489	17.2%	2356	82.8%	2845
High referrer	Low	1289	18.3%	5741	81.7%	7030
	High	2386	17.5%	11232	82.5%	13618
Overall		**3675**	**17.8%**	**16973**	**82.2%**	**20648**

*see Appendix 2b for Lakes DHB data

Table 4. The number of HSCan referrals accepted.

Characteristics		Not accepted		Accepted		Overall
HSCan-GP	No	3548	18.2%	15993	81.8%	19541
	Yes	127	11.5%	980	88.5%	1107
Overall		**3675**	**17.8%**	**16973**	**82.2%**	**20648**

Outcomes from colonoscopy following referral from New Zealand general practice

Lawrenson, R, Moosa, S, Warren, J, van Dalen, R, Chepulis, L, Blackmore, T, Lao, C, Mayo, C, Kidd, J, Firth, M, Stokes, T, Elwood, M, Weller, D, Emery, J. Outcomes from colonoscopy following referral from New Zealand general practice (see Appendix 5)

Waikato DHB has a population of 400,000, with 23% of the population identifying as Māori. As mentioned previously, generally all referrals are reviewed to see whether they will be offered as a First Specialist Assessment (FSA), but for patients with clear symptoms and who are of the appropriate age range, GPs can make a direct referral for colonoscopy – with specialist approval.

We aimed to identify what proportion of patients having a colonoscopy in the Waikato DHB have an underlying colorectal cancer, the factors associated with the likelihood of this diagnosis, and to determine differences in colonoscopy rates between different population sub-groups.

Method

The population investigated were patients referred to general surgery, gastroenterology or direct to colonoscopy at Waikato DHB from 01 January 2015 to 31 December 2017 (see page 24 and Appendix 5 for further description of methodology). The extracted dataset included patient's age, gender, ethnicity, date of referral, whether the patient had colonoscopy, whether it was direct access colonoscopy, whether the general practice was a high referrer (practices were either labelled above the median or below the median referral rate), GP label of HSCan, and the hospital label of HSCan after triage of the referral.

We first analysed the characteristics of patients who were having colonoscopy and compared these to the characteristics of patients who had no colonoscopy. We then analysed which patients were diagnosed with CRC among those having a colonoscopy. The characteristics of patients who had CRC were compared to patients who had did not have CRC.

Results

During the period from 01 January 2015 to 31 December 2017, 20,648 patients were referred to general surgery, gastroenterology or direct to colonoscopy and 6,718 patients had a colonoscopy (see Table 5). The probability of having a colonoscopy increased with age (p-value<0.001). Female patients were slightly more likely to have a colonoscopy than male patients (33.6% vs 31.2%, p-value<0.001), and non-Māori patients were more likely to have a colonoscopy than Māori patients (33.9% vs 23.7%, p-value<0.001). Patients with a GP label of HSCan or hospital label of HSCan were more likely to have a colonoscopy than those without the labels.

After adjustment for age, gender, year of referral, whether the GP practice was a high referrer, GP label of HSCan, hospital label of HSCan and interaction term (HSCan-GP x HSCan-Hospital), the odds ratio of Māori patients having a colonoscopy was 0.66 (95% CI: 0.60-0.73) (see Table 2 in Appendix 5). The adjusted odds ratio of the GP practice being a high referrer in having a colonoscopy was 0.94 (95% CI: 0.88-1.00). The adjusted odds ratio of a GP label of HSCan and hospital label of HSCan in having a colonoscopy was 2.22 (95% CI: 1.92-2.56) and 1.74 (95% CI: 1.26-2.42), respectively. After adjustment, gender and year of referral did not have a significant impact on having a colonoscopy or not.

Among the patients who had a colonoscopy, 372 (5.5%) of them were diagnosed with CRC (see Table 3 in Appendix 5). The probability of having CRC increased with age, from 1.5% of patients aged 30-49 years to 9.6% of patients aged 70+ years (p-value<0.001). Male patients were more likely to have CRC than female patients (7.1% vs 4.3%). Among patients who had a colonoscopy, 14.7% of patients with a GP label of HSCan were diagnosed with CRC

compared to 4.7% of patients who had no GP label of HSCan (p-value<0.001), and 17.2% of patients with a hospital label of HSCan were diagnosed with CRC compared to 5.1% of patients who had no hospital label of HSCan (p-value<0.001). The proportion of patients who had CRC was similar by ethnicity, year of referral, whether it was direct access colonoscopy, and whether the GP practice was a high referrer.

After adjustment for age, gender, ethnicity, year of referral, whether it was direct access colonoscopy or not, whether the GP practice was a high referrer or not, hospital label of HSCan and interaction term, the odds ratio of a GP label of HSCan in being diagnosed with CRC was 2.34 (95% CI: 1.70-3.22) (see Table 4 in Appendix 5). The adjusted odds ratio of a hospital label of HSCan in being diagnosed with CRC was 2.43 (95% CI: 1.18-5.02). The odds ratio of age (for each additional year) and gender (men compared to women) in being diagnosed with CRC was 1.05 (95% CI: 1.04-1.06) and 1.67 (95% CI: 1.35-2.07), respectively. There was no difference in the risk of an underlying CRC for Māori compared to non-Māori or for high referrers compared to low referrers.

Table 5. Characteristics of patients referred for colonoscopy.

Characteristics		**No colonoscopy**		**Had colonoscopy**		**p-value**	**Overall**
Age group	30-49	4415	78.0%	1244	22.0%	**<0.001**	5659
	50-59	2829	67.2%	1381	32.8%		4210
	60-69	2829	60.6%	1843	39.4%		4672
	70+	3857	63.2%	2250	36.8%		6107
Gender	Female	7483	66.4%	3790	33.6%	**<0.001**	11273
	Male	6447	68.8%	2928	31.2%		9375
Ethnicity	Non-Māori	11759	66.1%	6044	33.9%	**<0.001**	17803
	Māori	2171	76.3%	674	23.7%		2845
Year	2015	4936	68.1%	2315	31.9%	**0.250**	7251
	2016	4488	66.8%	2235	33.2%		6723
	2017	4506	67.5%	2168	32.5%		6674
High referrer	Low	4709	67.0%	2321	33.0%	**0.290**	7030
	High	9221	67.7%	4397	32.3%		13618
HSCan-GP	Yes	522	47.2%	585	52.8%	**<0.001**	1107
	No	13408	68.6%	6133	31.4%		19541
HSCan-Hospital	Yes	221	48.8%	232	51.2%	**<0.001**	453
	No	13709	67.9%	6486	32.1%		20195
Overall		**13930**	**67.5%**	**6718**	**32.5%**		**20648**

Discussion

Colonoscopy is a common diagnostic procedure in patients referred to general surgery or gastroenterology, with 32.5% of patients undergoing the procedure. Thus approximately 1.6% (6346/400,000) of patients residing in the Waikato DHB in a three year period underwent colonoscopy. This is similar to the 2% found in the Netherlands, although the proportion who were found to have CRC in our sample was greater. Older patients and those who had an HSCan label were more likely to receive a colonoscopy. This is unsurprising as we know the risk of pathology increases with age and if the clinical picture suggests cancer then these patients should be prioritised. There was a small and probably clinically insignificant difference in the rate of cases accepted for colonoscopy after referral from high referrers. This may be due to different risk indicators in patients referred by high referrers. After adjustment for other factors, Māori were 34% less likely to have a colonoscopy. While Maori have a lower incidence of CRC than non-Māori, the size of the difference was surprising and needs further investigation. We know that there are differences in the treatment of Māori patients with CRC[15] and this would indicate that these differences extend to the diagnostic pathway.

This study has shown that the conversion rate for CRC following colonoscopy in patients referred from GPs to specialist public hospital care is 5.5%. This is similar to the conversion rate found in the national screening pilot where patients underwent colonoscopy following a positive Faecal Immunological Test (FIT) [77]. This does not mean that 94.5% are negative, as a significant proportion of patients will have adenoma or other relevant pathology - as was found in the screening program [77]. It has been shown that the use of FIT can help rule out CRC in patients presenting in primary care with symptoms [78]. Thus it is possible that even greater efficiency could be gained in the diagnostic pathway for symptomatic patients which would free up colonoscopy facilities for screening purposes. When considering the underlying likelihood of CRC being found, age was obviously a significant factor with a steep rise in risk with age from 1.5 % in younger patients to 9.6% of patients 70+ years having CRC. Men were much more likely to have CRC with 7.1% conversion rate compared with women at 4.3%. These findings support the guidance for referral.

However, we know that there is also an increase in the incidence of CRC in younger patients in NZ [43] and if cases are not to be missed it may still be worthwhile offering colonoscopy to younger patients in order to exclude cancer. While there was no difference in the likelihood of Māori undergoing colonoscopy having CRC (5.6% vs 5.5% in non-Māori) we know the incidence of CRC in Māori is reported to be less than in non-Māori. If Māori rates of colonoscopy were similar to non-Māori we may find that the positivity rate would fall in line with the known lower incidence of CRC in Māori. The characteristics of the general practice where patients were registered did not seem to influence the conversion rate – thus those patients referred for direct colonoscopy did not differ, and there was no difference in the rate of high referrers compared to low referrers. However, if the GP had indicated an HSCan and a colonoscopy was carried out, then the conversion rate was 14.7%. While the rate in those deemed an HSCan by the hospital specialist team was higher at 17.2%, this was based on only 232 cases. One could argue that the sensitivity and specificity of a GP identification of an HSCan is such that all these patients should be offered an urgent colonoscopy.

Implications

The implications of these findings for policy include the need for the NZ Bowel Cancer guidelines to reassess the use of the HSCan and two week wait rule for patients deemed at high suspicion of cancer by their GP. We would argue that all patients deemed at high risk by their GP should be offered timely colonoscopy and that further delay by a further triage step in the referral pathway is unnecessary. We also believe that it is timely for NZ to review their guidelines for diagnosis in the light of the UK NICE

guidance [79] and introduce the option of a FIT test in general practice to help rule out the need for referral for colonoscopy. Finally, given the poor outcomes for Māori following a diagnosis of CRC, the finding of a lower use of colonoscopy in Māori needs further research to better understand the reasons for this difference compared to non-Māori .

How do blood tests help in the diagnosis of colorectal cancer?

Most patients with abdominal symptoms and signs indicating a possible diagnosis of CRC will have a blood test. Usually this will include a full blood count and may include iron studies [80]. These blood tests can provide useful information as to the underlying risk of CRC and the likelihood of positive or negative diagnosis. Generally, only 2-5% of patients referred for investigation by GPs will have an underlying CRC [81]. If the risk of CRC is less than 1% then it may be reasonable to manage these patients expectedly. On the other hand, patients with an underlying risk of 3% or greater could be considered appropriate for diagnostic procedures such colonoscopy or CT colonography.

Managing patients with a risk of 1-3% will depend on health system resources. Previous studies have shown that anaemia - especially proven iron deficiency anaemia - is associated with an increased likelihood of CRC. This is gender dependent – iron deficiency anaemia in women is commonly associated with conditions other than cancer. In men there is an increased likelihood of an underlying CRC associated anaemia [82]. Recently, a systematic review [83] has shown an association between CRC and a low haemoglobin and mean corpuscular volume (MCV) or a high white cell count or raised platelets. Another review showed a haemoglobin <13gdL was a useful criteria for referral for further investigation [84]. Some studies have also shown an association with a raised platelet count and the increased risk of cancer, including increased risk of CRC. Other criteria such as a raised platelet count, MCV and white cell count are less well defined.

The Waikato DHB has a population of 400,000 with 75 general practices and one public hospital provider – Health Waikato. Referrals from general practice to the hospital system are triaged by the hospital. Laboratory tests are undertaken by a single community provider (Pathlab) who have an electronic record of all tests undertaken. We aimed to establish which blood tests were predictive of an underlying CRC.

Methods

The study population included patients referred to general surgery, gastroenterology or directly to colonoscopy at the WDHB from 01 January 2015 to 31 December 2017. The referral data were linked to the National Cancer Register to identify any cancer diagnosis for the referred patients from 01 January 2015 to 31 December 2018. The referral data were also linked to the Pathlab data through the National Health Index (NHI) number to identify the results of six relevant blood tests: haemoglobin level, mean corpuscular volume (MCV), platelet level, iron level, ferritin and transferrin. Patients who had any of the six relevant blood tests within 3 months before the referral date, and patients who did not have any of these blood tests within 3 months before the referral date but within 1 month after the referral date were included.

Haemoglobin level was classified into <120 and 120+ g/L. The MCV level was grouped into <80, 80-99 and >99 fL. The platelet level was stratified into <150, ≥150&<250, 250-375 and >375 x 109/L for all patients. The iron level was classified into <10 and 10+ μmol/L, and the ferritin level was divided into <20 and 20+ μg/L, and the transferrin was stratified into <2, 2-3.6, and >3.6 μg/L. Iron deficiency anaemia was defined as having a ferritin level of <20 μg/L and a haemoglobin level of <120 g/L. Patients having unknown iron deficiency anaemia status were those having a ferritin level of <20 μg/L but with unknown anaemia status, those having anaemia but with an unknown ferritin level, and those with both unknown anaemia and unknown ferritin level. Age at referral was classified into four age groups: <50, 50-59, 60-69 and 70+ years. Ethnicity was grouped into Māori and non-Māori.

The six relevant blood test results were compared between patients who had no cancer, CRC and other cancers. The likelihood ratio of CRC were also calculated for these blood test results. Stepwise logistic regression was used to estimate the adjusted odds ratio of these blood tests in the probability of being diagnosed with CRC after adjustment for gender, age, ethnicity and other blood tests. In the first regression model, we did not include iron deficiency anaemia status but included haemoglobin level and ferritin level. In the second regression model, we included iron deficiency anaemia status but did not include haemoglobin level and ferritin level.

Results

We identified 20,648 patients referred in 2015-2017. Of these patients, 12,005 had any of the six relevant blood tests within 3 months before the referral date, and 1,052 patients did not have any of these blood tests within 3 months before the referral date but did within 1 month after the referral date. In total, 13,057 patients were included for analysis (Figure 4), including 7,387 women and 5,670 men, and 1,505 Māori patients and 11,552 non-Māori patients.

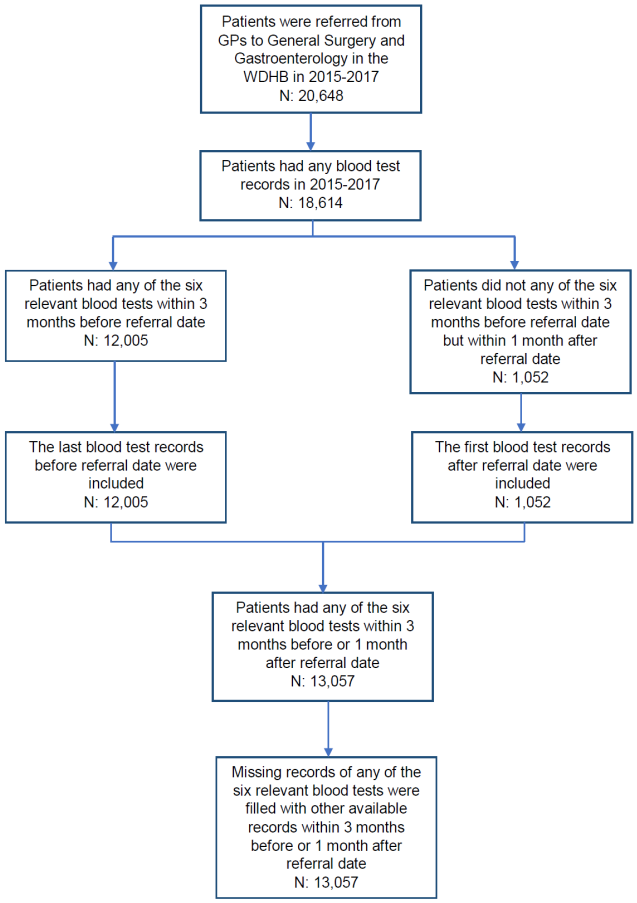


Figure 4. The number of blood tests recorded for patients referred by GPs to general surgery and gastroenterology at Waikato DHB 2015-2017.

Of these patients, 342 (2.6%) were diagnosed with CRC (Figure 5). The probability of being diagnosed with CRC varied by the blood results. Patients with a haemoglobin level of <120 g/L, a platelet level of ≥375 x 109/L and a MCV level of <80 fL had the highest risk of being diagnosed with CRC (22/148, 14.9%). The respective likelihood ratios of having CRC for patients having a haemoglobin level of <12 g/L, a platelet level of ≥375 x 109/L and a MCV level of <80 fL were 2.62, 2.87 and 3.03 (see Table 6).

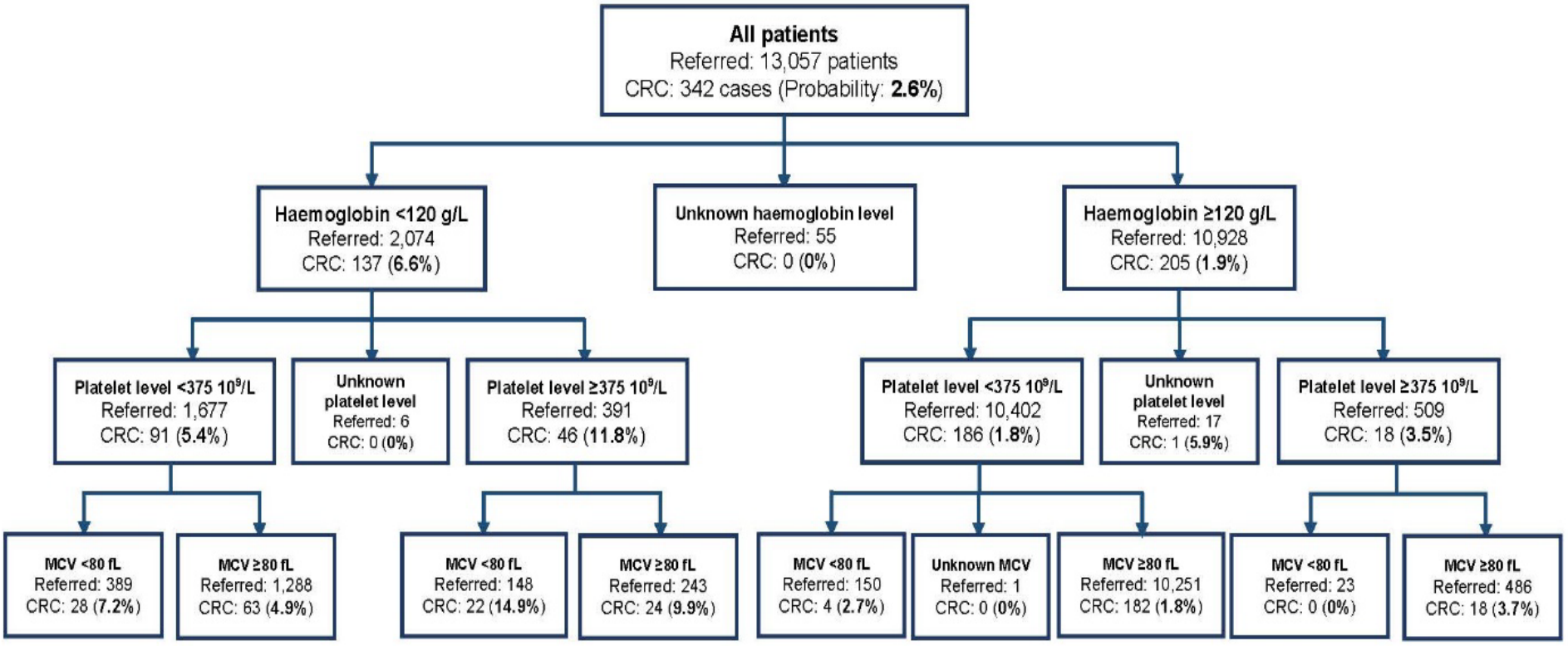


Figure 5. Haemoglobin level, platelet level and MCV level of patients referred to Waikato DHB 2015-2017.

Table 6. Characteristics and blood test results of referred patients.

Characteristics	No cancer		CRC		Other cancers		Total	Likelihood ratio for CRC
Gender								
Female	6911	(93.6%)	149	(2.0%)	327	(4.4%)	7387	-
Male	5098	(89.9%)	193	(3.4%)	379	(6.7%)	5670	-
Age group (years)								
<50	3101	(98.1%)	12	(0.4%)	48	(1.5%)	3161	-
50-59	2436	(94.3%)	36	(1.4%)	110	(4.3%)	2582	-
60-69	2776	(91.3%)	81	(2.7%)	182	(6.0%)	3039	-
70+	3696	(86.5%)	213	(5.0%)	366	(8.6%)	4275	-
Ethnicity								
Non-Māori	10630	(92.0%)	314	(2.7%)	608	(5.3%)	11552	-
Māori	1379	(91.6%)	28	(1.9%)	98	(6.5%)	1505	-
Haemoglobin level (g/L)								
<120	1733	(83.6%)	137	(6.6%)	204	(9.8%)	2074	2.62
120+	10221	(93.5%)	205	(1.9%)	502	(4.6%)	10928	0.71
Unknown	55	(100.0%)		(0.0%)		(0.0%)	55	
MCV (fL)								
<80	609	(85.3%)	54	(7.6%)	51	(7.1%)	714	3.03
80-99	10887	(92.3%)	282	(2.4%)	621	(5.3%)	11790	0.91
>99	457	(92.0%)	6	(1.2%)	34	(6.8%)	497	0.45
Unknown	56	(100.0%)		(0.0%)		(0.0%)	56	
Platelet level (x 10^9/L)								
<150	504	(88.3%)	7	(1.2%)	60	(10.5%)	571	0.46
≥150&<250	5618	(92.7%)	128	(2.1%)	317	(5.2%)	6063	0.80

250-375	5059	(92.8%)	142	(2.6%)	253	(4.6%)	5454	0.99
>375	753	(84.5%)	64	(7.2%)	74	(8.3%)	891	2.87
Unknown	75	(96.2%)	1	(1.3%)	2	(2.6%)	78	
Iron level (µmol/L)								
<10	919	(85.9%)	71	(6.6%)	80	(7.5%)	1070	1.86
10+	2278	(93.4%)	58	(2.4%)	102	(4.2%)	2438	0.64
Unknown	8812	(92.3%)	213	(2.2%)	524	(5.5%)	9549	
Ferritin (µg/L)								
<20	360	(87.4%)	34	(8.3%)	18	(4.4%)	412	2.36
20+	2836	(91.6%)	95	(3.1%)	164	(5.3%)	3095	0.83
Unknown	8813	(92.3%)	213	(2.2%)	524	(5.5%)	9550	
Transferrin (µg/L)								
<2	187	(82.4%)	10	(4.4%)	30	(13.2%)	227	1.21
2-3.6	2797	(91.8%)	108	(3.5%)	143	(4.7%)	3048	0.96
>3.6	213	(91.4%)	11	(4.7%)	9	(3.9%)	233	1.30
Unknown	8812	(92.3%)	213	(2.2%)	524	(5.5%)	9549	
Iron deficiency anaemia								
No	10743	(93.0%)	240	(2.1%)	568	(4.9%)	11551	0.92
Yes	231	(85.2%)	27	(10.0%)	13	(4.8%)	271	4.79
Unknown	1035	(83.8%)	75	(6.1%)	125	(10.1%)	1235	
Total	**12009**	(92.0%)	**342**	(2.6%)	**706**	(5.4%)	**13057**	

Iron studies were only performed in a small proportion (26.6%) of patients. However, iron level and ferritin level were found to be associated with a likelihood ratio of CRC of 1.86 and 2.36. Iron deficiency anaemia had a likelihood ratio of CRC of 4.79.

In the first stepwise regression model (not including iron deficiency anaemia, Table 7), the adjusted odds ratio of men being diagnosed with CRC compared to women was 1.96 (95% confidence interval (CI): 1.57-2.47). Age was an important factor in probability of having CRC, with an adjusted odds ratio of 12.79 (95% CI: 7.09-23.05) for patients aged 70+ years compared those aged less than 50 years. Ethnicity was not a significant factor and therefore was not included in the final stepwise model results. Apart from haemoglobin level, MCV and platelet level, ferritin level was also found to be an important factor for predicting the risk of CRC, with an adjusted odds ratio of 1.59 (95% CI: 1.01-2.50) for those having a ferritin level of <20 µg/L compared to those 20+ µg/L.

When including iron deficiency anaemia instead of haemoglobin level and ferritin level in the stepwise regression model (Table 8), the adjusted odds ratios for gender, age group, MCV, platelet level were similar to the results in Table 7. However, iron level was found significant in this regression, with an adjusted odds ratio of 1.63 (95% CI: 1.11-2.40) for patients with an iron level of <10 µmol/L compared to patients with an iron level of 10+ µmol/L. The adjusted odds ratio of CRC for those having iron deficiency anaemia compared to those without iron deficiency anaemia was 1.76 (95% CI: 1.05-2.95).

Table 7. Adjusted odds ratio of having colorectal cancer by stepwise logistic regression model.

Factors	Odds ratio	95% CI	p-value
Gender			
Female	Ref		
Male	1.96	(1.57 - 2.47)	<0.001
Age group (years)			
<50	Ref		
50-59	3.91	(2.03 - 7.55)	<0.001
60-69	7.23	(3.92 - 13.31)	<0.001
70+	12.79	(7.09 - 23.05)	<0.001
Haemoglobin level (g/L)			
<120	1.89	(1.44 - 2.47)	<0.001
120+	Ref		
MCV (fL)			
80-99	Ref		
<80	1.55	(1.07 - 2.25)	0.019
>99	0.42	(0.18 - 0.95)	0.037
Platelet level (x 10^9/L)			
≥150&<250	Ref		
<150	0.48	(0.22 - 1.03)	0.060
250-375	1.43	(1.11 - 1.84)	0.005
>375	3.11	(2.21 - 4.37)	<0.001
Unknown	2.25	(0.29 - 17.33)	0.435
Ferritin (µg/L)			
<20	1.59	(1.01 - 2.50)	0.046
20+	Ref		
Unknown	0.85	(0.66 - 1.10)	0.220

Table 8. Adjusted odds ratio of having colorectal cancer using iron deficiency anaemia by stepwise logistic regression model.

Factors	Odds ratio	95% CI		p-value
Gender				
Female	Ref			
Male	1.96	(1.56 -	2.46)	<0.001
Age group (years)				
<50	Ref			
50-59	3.90	(2.02 -	7.54)	<0.001
60-69	7.17	(3.89 -	13.21)	<0.001
70+	12.77	(7.09 -	23.00)	<0.001
MCV (fL)				
80-99	Ref			
<80	1.55	(1.08 -	2.23)	0.019
>99	0.44	(0.19 -	0.99)	0.047
Unknown				
Platelet level (x 10^9/L)				
≥150&<250	Ref			
<150	0.47	(0.22 -	1.02)	0.058
250-375	1.42	(1.10 -	1.82)	0.007
>375	3.08	(2.20 -	4.32)	<0.001
Unknown	2.25	(0.29 -	17.36)	0.435
Iron level (µmol/L)				
<10	1.63	(1.11 -	2.40)	0.013
10+	Ref			
Unknown	0.46	(0.33 -	0.65)	<0.001
Iron deficiency anaemia				
No	Ref			
Yes	1.76	(1.05 -	2.95)	0.032
Unknown	2.32	(1.69 -	3.18)	<0.001

Discussion

In patients referred to a general surgery outpatients service for investigation, the presence of a raised platelet count of >375 X109/L was associated with a more than double risk of cancer in both men and women. Thus the underlying risk was 7.2%, suggesting that this finding is a useful marker for GPs to assess when deciding on the need for referral. Similarly, 6.6% of patients with an Hb of less than 120 dg/L had a risk of an underlying cancer compared to 2% of those with a normal Hb. If this was a proven iron deficiency anaemia then the risk rose to 10%.

Study Two: The Diagnosed Colorectal Cancer

Phase 1: Patient perspectives of factors facilitating and impeding their access to diagnosis

Patient-reported diagnostic intervals to colorectal cancer diagnosis in the Midland region of New Zealand: a prospective cohort study

Blackmore, T.L., Chepulis, L., Keenan, R., Kidd, J., Stokes, T., Firth, M., Elwood, M., Jackson, C., Weller, D., Emery, J., Lawrenson, R. Patient reported delays to diagnosis of colorectal cancer patients in the Midland region of New Zealand 2021, Family Practice (under review) (see Appendix 6)

CRC is more difficult to diagnose in terms of its presenting symptoms than other cancers [85, 86]. The appraisal interval of the Models of Pathway to Treatment (MPT), where patients recognise that symptoms need medical investigation, has high potential for delay [87], especially if symptoms are intermittent and have been previously experienced or considered 'normal'. In these cases, patients often postpone help-seeking, self-manage, or wait for symptom resolution, only consulting a general practitioner (GP) when conditions have worsened [88]. Even if symptoms have been appraised and the decision to consult a GP is made, patients face a number of barriers in the help-seeking phase of the MPT, such as fear of tests [87], worry about what investigations might find [89], or symptom embarrassment [34]. These barriers make the quality of the patient-GP relationship even more important as a facilitator to help-seeking.

GPs also influence the diagnostic interval as patient's transition to the diagnostic phase. CRC is not common in general practice, with GPs typically diagnosing one CRC patient per year [90]. GPs must differentiate presenting symptoms that may be due to cancer from benign conditions, all while also considering a patient's medical history and the presence of comorbid conditions. With CRC diagnoses rare, more common diagnoses are often considered first, especially in the light of existing GI issues or other comorbidity [91], leading to further delay and multiple GP consultations [85]. Furthermore, even if a GP recognises further investigation is warranted, as noted earlier in this report, NZ GPs have less access to specialists tests like X ray and colonoscopy [72].

In this phase, we interviewed newly diagnosed CRC patients within the Midland region to investigate reasons for lengthy diagnostic intervals.

Methods

Patients were recruited primarily from Waikato, Tairawhiti and Lakes DHBs. Patients were eligible for recruitment if they had been diagnosed within 12 months (study period from 2016-2019) and had not been diagnosed through regional screening. Data were collected via interview to deliver a structured questionnaire based on the MPT [9] (see Figure 1) and a modified SYMPTOM questionnaire [62] (see page 15 and Appendix 6 for further description of the methodology).

Results

For analysis, we combined the appraisal/help seeking interval, defined as the period from patient-reported first symptom recognition (first notice of body changes or symptoms) to date of first GP presentation or ED admission (when a clinician starts investigations or referral). The GP diagnostic interval was calculated as the date of first GP consult/ED admission to date of diagnosis (defined as date of first confirmation of cancer) and the total diagnostic interval (TDI) was taken as the date of first symptom onset to date of diagnosis. Delay in each of these intervals was defined as >120 days and no delay was classified as <120 days, based on Australian clinical guidelines [92].

Table 9. Characteristics of patients newly diagnosed with CRC in the Midland region of NZ (2016-2019) (N=195).

Characteristic	N	%
Age group		
<60	49	25.1
60+	146	74.9
Ethnicity		
non-Māori	165	84.6
Māori	29	14.9
Missing	1	0.5
Gender		
Male	109	55.9
Female	86	44.1
Comorbidities		
0	74	37.9
1+	121	62.1
Number of first-reported symptoms		
0	11	5.6
1	145	74.4
2+	39	20.0
First-reported symptom		
COBH	52	26.7
Rectal bleeding	62	31.8
Abdominal/anal pain	32	16.4
Weight loss	5	2.6
Loss of appetite	1	0.5
Fatigue	12	6.2
Other*	20	10.3
No reported symptoms	11	5.6
Diagnostic pathway		
GP	125	64.1
Incidental	29	14.9
ED	30	15.4
Other	11	5.6
Did your GP refer for colonoscopy?		
No	72	36.9
Yes	108	55.4
NA/Missing/Don't know	15	7.7
Number of GP visits		
0-5	128	65.6
6+	66	33.8
Don't know	1	0.5

Data from 195 patients were analysed (see Table 9).

Appraisal/help-seeking interval

Table 10 shows the population characteristics stratified by each interval. Data from the 11 patients who reported zero symptoms were excluded from all further analyses, giving a sample size of 184. Only 35 (19.0%) patients appraised symptoms and engaged in help-seeking > 120 days. Of these, 20 (57.1%) were experiencing rectal bleeding. Patients who delayed seeking a medical consultation were more likely to be <60 (p=0.445) and male (p=0.537). They were also more likely to have reported COBH as their first noticed symptom (p=0.072).

GP Diagnostic interval

After consulting their GP, 66 (35.9%) patients experienced an interval of >120 days. Patients who experienced longer intervals during this phase were significantly more likely to be Māori (p=0.010) and female (p=0.039). ED admission, or being diagnosed through an incidental or 'other' finding was the faster route to diagnosis (p=0.000).

Total diagnostic interval

Over half (56.8%) of all patients experienced a TDI >120 days. Factors significantly associated with a TDI >120 days were COBH as a first symptom (p=0.043) and having six or more GP consultations prior to diagnosis (p=0.022).

The median TDI across the whole cohort was 151 days (IQR 61-365), 30 days (IQR 0-93) for the appraisal/help-seeking interval and 66 days (IQR 27-235) for the GP diagnostic interval. Patients <60 had a higher median TDI than those aged 60+ (see Table 11). Māori, and female patients had a longer median TDI and GP diagnostic interval. ED presentation had the shortest median days across all intervals, as did rectal bleeding, with the exception of the appraisal/help seeking phase, where abdominal or anal pain had the shortest median days. Six or more GP consultations had the highest median TDI.

Table 10. The characteristics of all symptomatic patients diagnosed with CRC in the Midland region of NZ (2016-2019), stratified by appraisal/help-seeking, GP diagnostic and total diagnostic interval (TDI) (n=184).

	Appraisal/Help-seeking Interval						GP Diagnostic Interval						Total Diagnostic Interval						Totals
Characteristic	**<120 days n=130**	**%**	**>120 days n=35**	**%**	**Unknown n=19**	**p**	**<120 days n=99**	**%**	**>120 days n=66**	**%**	**Unknown n=19**	**p**	**<120 days n=79**	**%**	**>120 days n=104**	**%**	**Unknown n=1**	**p**	**n=184**
Age group																			
<60	32	72.7	12	27.3	4	0.445	26	59.1	18	40.9	4	0.911	17	35.4	31	64.6	0	0.237	48
60+	98	81.0	23	19.0	15		73	60.3	48	39.7	15		62	45.9	73	54.1	1		136
Ethnicity																			
non-Māori	114	79.2	30	20.8	12	**0.016**	90	62.5	54	37.5	12	**0.010**	70	45.2	85	54.8	1	0.341	156
Māori	16	80.0	4	20.0	7		9	45.0	11	55.0	7		9	33.3	18	66.7	0		27
Missing	0	0.0	1	100.0	0		0	0.0	1	100.0	0		0	0.0	1	100.0	0		1
Gender																			
Male	68	76.4	21	23.6	12	0.537	61	68.5	28	31.5	12	**0.039**	48	48.0	52	52.0	1	0.178	101
Female	62	81.6	14	18.4	7		38	50.0	38	50.0	7		31	37.3	52	62.7	0		83
Comorbidities																			
0	51	79.7	13	20.3	6	0.784	40	62.5	24	37.5	6	0.723	30	42.9	40	57.1	0	0.535	70
1+	79	78.2	22	21.8	13		59	58.4	42	41.58	13		49	43.4	64	56.6	1		114
First reported symptom																			
COBH	33	68.8	15	31.3	4	0.072	27	56.3	21	43.8	4	0.157	16	30.8	36	69.2	0	**0.043**	52
Bleeding	50	89.3	6	10.7	6		40	71.4	16	28.6	6		35	56.5	27	43.5	0		62
Abdominal/anal pain	24	80.0	6	20.0	2		17	56.7	13	43.3	2		14	43.8	18	56.3	0		32
Other	23	74.2	8	25.8	7		15	48.4	16	51.6	7		14	37.8	23	62.2	1		38
Diagnostic pathway																			
GP	94	78.3	26	21.7	5	**0.000**	72	60.0	48	40.0	5	**0.000**	53	42.4	72	57.6	0	0.717	125
Incidental	10	83.3	2	16.7	11		6	50.0	6	50.0	11		8	36.4	14	63.6	1		23
ED	21	75.0	7	25.0	1		19	67.9	9	32.1	1		15	51.7	14	48.3	0		29
Other	5	100.0	0	0.0	2		2	40.0	3	60.0	2		3	42.9	4	57.1	0		7
Number of GP visits																			
0-5	85	77.3	25	22.7	11	0.788	68	61.8	42	38.2	11	0.062	52	43.3	68	56.7	1	**0.022**	121
6+	44	81.5	10	18.5	8		30	55.6	24	44.4	8		26	41.9	36	58.1	0		62
Don't know	1	100.0	0	0.0	0		1	100.0	0	0.0	0		1	100.0	0	0.0	0		1

After adjusting for all factors, patients reporting rectal bleeding were less likely to experience a long TDI (OR 0.27, 95% CI: 0.12-0.61) and appraisal/help-seeking interval (OR, 0.18, 95% CI: 0.06-0.57). Compared to patients aged >60, younger patients were more likely to experience longer appraisal/help-seeking intervals (OR, 3.45, 95% CI: 1.25-9.55) and females were more likely to experience a long GP diagnostic interval (OR, 2.19, 95% CI: 1.08-4.44).

Discussion

As expected from a largely unscreened population, the diagnostic pathway for most patients was through general practice. Over half of the cohort experienced a TDI of more than 120 days. Rectal bleeding and COBH were the most common first-noticed, patient-reported symptoms. Rectal bleeding was associated with a shorter appraisal/help-seeking, GP diagnostic and TDI. Younger patients experienced longer times across all intervals and Māori and female patients were more likely to experience a longer TDI and GP diagnostic interval.

Young patients delayed seeking medical help beyond 120 days, perhaps consistent with the public perception that CRC more commonly affects older age groups. Patients who first-reported a COBH also delayed consulting a GP, and almost 20.0% never told their GP about their COBH. This likely reflects the difficulty facing patients in discriminating bowel changes from more serious conditions, especially if individuals have pre-existing GI issues or consider irregular bowel habits as 'normal'. We reiterate the importance of increased public awareness of CRC to assist patients in their appraisal of symptoms and facilitate prompt help-seeking.

Our findings that Māori experience longer diagnostic intervals are consistent with other NZ CRC studies [70, 93], but, as with those studies, are limited by a small sample size. That said, we support the need for urgent action addressing the inequity of the national bowel screening programme - with the age set at 60 for all it ignores the higher number of CRC in Māori at a younger age, contributing to poorer health outcomes [94].

As noted earlier in this report, NZ GPs face barriers to referring patients for the required diagnostic tests. NICE guidelines [79] recommend the Faecal Immunochemical Test (FIT) to discriminate patients with non-specific abdominal pain and/or COBH, but access to FIT is non-existent in the NZ public health system outside bowel screening, which is currently regional only. FIT is an option to reduce missed diagnoses, but GPs cannot currently use FIT for symptomatic triage of CRC. Another method to potentially reduce diagnostic delay of rectal cancer is use of the digital rectal examination (DRE). A failure to conduct DREs was a major cause of complaint in the HDC report (2004-2013)[18] and has been frequently cited as a continuing problem in CRC research [86, 95]. Taken from the diagnostic experience that patient reported in this study, a failure to perform DREs may be an ongoing issue.

Conclusions

Many NZ patients newly diagnosed with CRC experience long diagnostic intervals, attributed to a combination of patient and health care provider factors. Young patients, Māori, females and patients experiencing a COBH may be at particular risk for greater chance of delay. With the diagnostic difficulty of CRC, we need to increase the public profile of CRC and symptom awareness for both patients and GPs. There needs to be concentrated efforts to ensure equity for Māori in the national screening programme, as well as in general access to diagnostics and treatment.

Table 11. Median number of days patients diagnosed with CRC in the Midland region of NZ (2016-2019) spent in the appraisal/help-seeking, GP diagnostic and total diagnostic intervals (TDI) (n=184).

Characteristic	Appraisal/Help-seeking Interval	GP Diagnostic Interval	Total Diagnostic Interval	Totals
	Median (IQR)	Median (IQR)	Median (IQR)	n
Age group				
<60	30 (0-138)	64 (30-345)	240 (63-562)	48
60+	30 (0-92)	69 (25-191)	133 (61-351)	136
Ethnicity				
non-Māori	30 (0-92)	62 (26-194)	133 (61-351)	156
Māori	22 (0-109)	170 (15-451)	195 (106-662)	27
Missing	–	–	–	1
Gender				
Male	30 (2-108)	53 (15-170)	122 (60-322)	101
Female	30 (0-92)	121 (38-327)	181 (68-613)	83
Comorbidities				
0	30 (1-92)	62 (29-202)	151 (61-343)	70
1+	30 (0-100)	86 (24-256)	143 (61-366)	114
Diagnostic pathway				
GP	31 (14-105)	75 (28-260)	151 (64-365)	125
Incidental	0 (0-26)	101 (35-868)	174 (57-822)	23
ED	1 (0-122)	47 (2-160)	107 (30-365)	29
Other	4 (0-33)	345 (52-945)	143 (81-662)	7
First reported symptom				
COBH	34 (14-174)	91 (31-223)	198 (91-654)	52
Rectal bleeding	16 (0-47)	54 (17-130)	104 (52-326)	62
Abdominal/anal pain	8 (0-94)	93 (7-206)	138 (49-297)	32
Other*	61 (7-127)	165 (21-344)	275 (76-409)	38
Number of GP visits				
0-5	30 (0-109)	64 (28-186)	142 (61-349)	121
6+	30 (0-91)	61 (8-221)	174 (65-444)	62
Don't know	32 (32-32)	32 (32-32)	64 (64-64)	1

How do colorectal cancer patients rate their GP: a mixed methods study

Blackmore T., Chepulis L., Keenan, R., Kidd, J., Emery J., Weller D., Stokes T., Lawrenson R. How do colorectal cancer patients rate their GP? 2021 BMC Family Practice (in press) (see Appendix 7)

Factors that instill patient confidence in GPs include explaining tests and treatments, involving patients in decisions about care and giving patients the perception that their symptoms are being taken seriously. When trust breaks down and care is perceived to be sub-optimal, conflict can ensue. As already noted in this report, a report for the HDC (2004-2013)[18] indicated that approximately 10% of complaints about GPs involved a perceived delay in diagnosis of cancer, and CRC was over-represented.

The patient-GP relationship is an integral aspect of the diagnostic process. A GP's interpersonal skills (e.g., listening, empathy, being non-judgmental) and technical competence (e.g., knowledge, performing physical examinations, proactively investigating, following up on referrals) can either facilitate or impede prompt diagnosis. Good GP communication helps patients feel connected to their GP and the care provided [96], but a lack of empathy, inattentive listening and not taking patients seriously can lead to negative patient-GP interactions [97], patient dissatisfaction [98] and complaints [99]. Technical competence is also an important consideration in the patient-GP relationship, but can be outweighed by interpersonal competence [100], highlighting the importance patients place on a GPs' personal style and the quality of the patient-GP relationship during interactions.

Given the prevalence of CRC complaints in primary care, we interviewed recently diagnosed patients using a structured questionnaire to investigate patient ratings of trust and confidence in their GP from symptom onset to diagnosis.

Participants

Participants were interviewed to deliver a structured questionnaire based on the MPT [9] and modified SYMPTOM questionnaire [62] (see page 15 and Appendix 7 for further description of the methodology). Section 3 of the questionnaire specifically asked about health service utilisation and the patient-GP experience using three questions:

Q26. Thinking about your last visit to a GP, how good was the doctor at explaining your health conditions and treatments in a way that you could understand?

Q27. How good was the doctor at involving you in decisions about your care, such as discussing different treatment options?

Q28. Did you have confidence and trust in the GP you saw?

Responses to these questions were collected using a 5 –point Likert rating scale ranging from 'Very good' to 'Very poor' (for Q26-27) and 'Yes definitely' to 'Not at all' (Q28). Free text comments were also recorded verbatim by the researcher during the interview.

Results

The characteristics describing the cohort are shown in Tables 1-4 of Appendix 7). Only 3.1% of all participants (n=6) rated their GPs communication as 'Poor' or 'Very poor' (Q26). The majority of participants (52.3%) rated their GP involving them in decisions about their care as 'Very good' (Q27). For Q28, which asked for an overall judgment of confidence and trust in their GP, 40 participants (20.5%) rated that level of confidence and trust as 'Yes, to some extent' or 'Not at all'. Of these, 13 participants gave a wholly 'Not at all' rating, 92.3% (12/13) of who had experienced a TDI of >120 days.

Free text comments

Theme 1: GP Interpersonal skills

The first theme identified related to interpersonal skills, which included communication, participants

feeling listened to, GPs showing empathy and taking symptoms seriously. Most participants rated their GP as 'Very good' or 'Good' in their communication:

….GP is fantastic - he takes the time to explain everything, and is very patient (Male, age 82, stage 1, TDI<120 days)

However, some participants voiced dissatisfaction with their GPs level of communication, expressing feelings of not being listened to, dismissal, and not having symptoms taken seriously:

I had a lot of symptoms, for more than a year that I was always telling him about. I think he thought I was a hypochondriac... Around August 2017 I was very sick, vomiting and tired. I went to the GP, he ruled out the flu and said it must be another infection and left it at that (Female, age 72, stage unknown, TDI>120 days)

Some participants felt their young age was the factor that led their GP to not take their symptoms seriously:

I have seen my GP countless times and was told back in 2016 that I was 'too young' to have bowel cancer when I asked if symptoms could be the start of something like that (Male, age 41, stage unknown, TDI>120 days)

However, some participants were more accepting of their GP's interpersonal style, which did not affect their overall perception or level of confidence and trust. One participant was blunt in his description of his GPs communication, yet still had total faith in his care:

He is terrible at explaining things. I have a long standing relationship with him, and even though he has quirky weird ways, he has proven his level of care to my family multiple times – when the chips are down, you can't beat him (Male, age 76, stage 3, TDI<120 days)

Theme 2: Technical competence

A GPs technical competence was also appraised by participants during appointments, and provided the second theme identified. Technical competence was often judged by the speed in which a referral was made, with some rating their confidence as low because of a perception that their GP had failed to promptly facilitate a diagnosis, or had misdiagnosed:

I don't have any confidence in the GP now. She was on the wrong track, had diagnosed 'microscopic colitis'. I had been complaining about worsening symptoms for months (Female, age 52, stage 3, TDI>120 days)

The GP diagnosed an ulcer for the abdominal pain and gave laxatives for the constipation (Female, age 73, stage unknown, TDI>120 days)

Of concern were the number of participants who reported being misdiagnosed in the absence of a physical examination, which for some, influenced their poor confidence rating:

The GP misdiagnosed prostate cancer without doing any prostate cancer checks (Male, age 70, stage 2, TDI>120 days)

I had been going to the GP multiple times to investigate symptoms. When I went to the GP over bleeding, he told me it was haemorrhoids, but didn't explore further. I knew it was not, as I was seeing a lot of blood (Female, age 41, stage 3, TDI>120 days)

However, there were still participants who, despite experiencing a long diagnostic interval, appraised technical competence positively, especially if their GP was actively engaged in investigating symptoms or if a patient's medical history was acknowledged as contributing to diagnostic difficulty:

One said I was 'too young for cancer' but still referred me, and did bloods (Female, age 31, stage 3, TDI>120 days)

I have a history of endometriosis, so felt their assessments were fair (Female, age 37, stage unknown, TDI>120 days)

Theme 3: Organisation of general practice care

Many participants commented on health system organisation, suggesting that some participants do not

view these as distinctly separate from the patient-GP relationship. Timing of appointments was a common concern, with short appointment times resulting in participants feeling rushed and not being given enough time for their concerns to be properly heard:

I changed GP - was sick of getting 10 minutes for one problem – my GP was just too blasé (Female, age 54, stage 3, TDI>120 days)

Continuity of care was another main concern. While busy practices might offer an appointment with another GP, participants often desired to see the same GP who they felt more comfortable with and who they perceived knew them best:

I changed practice two years ago, due to a lack of continuity of a regular GP (Male, age 72, stage unknown, TDI<120 days)

However, other participants were more pragmatic about having consultations with different GPs:

They do a good job. Don't mind seeing different doctors as they have different ideas (Male, age 77, stage unknown, TDI>120 days)

Discussion

While it was encouraging to see many participants rating GP communication positively, several participants voiced dissatisfaction with the quality of their patient-GP relationship. Participants also expressed dissatisfaction with the speed in which specialist referrals were made, often perceiving that their GP 'took too long to diagnose', and felt that appointment length was not long enough to have their issues heard. Getting an appointment with a desired GP was also highly valued. Irrespective of TDI, participants expressed frustration at not being able to see the same GP, or being offered a different GP for each appointment. This is a particular issue for Māori patients, who value continuity of care [101] but do not get offered the same choice of GP appointments [102].

We report that long diagnostic intervals for CRC patients are occurring in primary care, associated with deficits in the patient-GP relationship that have been previously raised in the HDC report (2004-2013) [18]. Increased funding into primary care might help address some of these ongoing issues. While the majority of participants in the current study had confidence and trust in their GP, the diagnostic experience was extremely negative for some participants, particularly young patients, Māori, females, and those who experienced a long diagnostic interval. Access to general practice plays a pivotal role and is particularly important to ensure equity for Māori patients.

We reiterate the importance of the quality of the patient-GP relationship in the diagnostic process. While the current organisation of the primary care system is out of the hands of most GPs, patients clearly do not separate issues such as short appointment times from the patient-GP relationship.

Phase 2: Patient semi-structured interviews

Barriers and facilitators to colorectal cancer diagnosis in New Zealand: a qualitative study

Blackmore, T.L., Norman, K., Kidd, J., Cassim, S., Chepulis, L., Keenan, R., Firth, M., Elwood, M., Stokes, T., Weller, D., Emery, J., Lawrenson, R. Barriers and Facilitators to Colorectal Cancer Diagnosis in New Zealand: A Qualitative Study, BMC Family Practice, 2020, 21: 206 (see Appendix 8)

As noted elsewhere in this report, patient, physician and health system delays are key factors associated with late stage diagnosis of CRC. A qualitative study of 20 men in Australia, for example, found delays were associated with patient misinterpretation of symptoms, a failure to attribute symptoms to cancer, and subsequent delays in consulting a health care professional [88]. Other studies have also linked longer diagnostic intervals to CRC symptoms, patient-GP communication about symptoms, public and GP awareness of CRC, and hospital system delays in referral and scheduling of colonoscopies [88, 95, 103].

Due to the high mortality rates of CRC in NZ and a lack of understanding of the pre-diagnostic experience from the patient's perspective, we investigated the potential barriers and facilitators of CRC diagnosis. Previous qualitative studies have discussed patient and system related delays to diagnosis using The Model of Pathways to Treatment (MPT) [51, 88, 103, 104] but this has not been explored in the NZ context. We aimed to understand the NZ patient experience during the CRC detection period, with a focus on barriers and facilitators to diagnosis.

Participants

All 28 participants in this study had been diagnosed with CRC within the previous year (study period from 2016-2019) and were purposively sampled to obtain representation across key groups (e.g., ethnicity, gender and those who had, and had not, experienced a long interval to diagnosis, as determined by the earlier quantitative study) (see page 15 and Appendix 8 for further description of the methodology).

Analytical Framework

The MPT [9] was used as a theoretical framework for the development of interviews and data analysis. Here we focused on the first three intervals of the MPT: appraisal, help seeking, and diagnostic. Initial coding by the interviewer identified barriers and facilitators to diagnosis. Codes were then grouped into themes based on the MPT model. Māori data were analysed collaboratively between the interviewer, a qualitative research colleague and a Māori researcher. Findings are presented as an overall summary of the participants who experienced delay and those who experienced no delay, followed by rich data within each of the MPT phases and their subthemes.

Appraisal Interval

1. Self-Appraisal

The first theme identified was self-appraisal. All symptomatic participants engaged in a period of symptom self-appraisal, which determined whether or not they consulted a GP. Self-appraisal typically began upon first symptom recognition, whereby the severity of that symptom was appraised and perceived either as 'normal' (i.e., similar to a previously experienced symptom) or abnormal (i.e., not previously experienced). If symptoms were normalised, participants typically felt unalarmed, and a GP was less likely to be consulted:

But I've been vegetarian for about 15 years, and I've always had a naturally low blood iron level. (Male, 65, stage 3)

Others attributed COBH to previous experiences of stomach ulcers or psychological conditions:

I have always had a funny guts for, you know years, and years and years…before that I'd actually had a stomach ulcer. So I thought, oh probably something like that. (Male, 43, stage 2).

A GP was also not consulted if a symptom was perceived as an isolated case (e.g., just one bout of bleeding) or if participants attributed symptoms to a benign health issue. One participant attributed food intake as being responsible for the blood in her stool:

Often, I used to, when I wipe my behind, I often used to look at it and think, mmm- is there a sign of red in that? But then it was persimmons season, and it was summer we'd been eating a lot of salads. Is it the beetroot, is it the tomatoes, is it the persimmons? I always found another excuse. (Female, 69, stage 4)

In contrast, when participants perceived their symptoms as abnormal (e.g., excessive bleeding from the bowel), a GP was more likely to be consulted:

It was just blood, everywhere, and the water just turned bright red … So I went up to the hospital. The emergency department. (Male, 67, stage 4)

Many of the Māori participants included the impact of their symptoms on their sociocultural environment in their self-appraisal. In particular, symptoms were perceived as less concerning if they could stay private, but once the symptoms became obvious to others around them, they decided to seek advice.

Sometimes when I was at work, I couldn't make it [to the toilet] and um, you sort of um, dirty underwear sort of thing. So changed my underwear every, twice a day, as it got really embarrassing you know? You are too frightened to sit down and have a smoko with the rest of the mates. And you know, they whether they could smell you, I don't know, but- (Male, 60, stage 3)

For all participants, symptoms such as abdominal pain, unexplained weight loss and nausea were perceived as abnormal, and so facilitated a faster GP consultation than other symptoms.

2. Self-Management

Self-management was a second theme identified in the appraisal interval. Once symptoms had been appraised, participants employed various self-management techniques. Self-management was usually informed by the type of symptom experienced, the participant's perception of their own level of health literacy and their previous experience of self-managing symptoms. Self-management ranged from over the counter medication (e.g., for symptoms such as diarrhoea, constipation, and nausea), to dietary or exercise routine changes, to simply waiting for psychological stress to abate:

It was bad diarrhoea. But, um, with the excitement of booking all our holiday and everything I just thought 'oh its excitement, it will disappear once all that's done'. (Female, 69, stage 4).

While self-managing, self-appraisal was commonly revisited as participants monitored the progress of the self-management strategies they were employing. Self-management, if successful, resulted in delayed help-seeking if participants felt symptoms had subsided to a more manageable level and therefore did not require professional medical help.

Help- Seeking Interval

3. Symptoms Worsen

During the help-seeking interval, the worsening of symptoms was an example of how severe symptoms had to get before a GP was consulted, so was an important facilitator to help-seeking. Self-management was often a temporary strategy, as participants not only reported the return of symptoms, but also usually experienced a pronounced increase in severity whereby symptoms became hard to manage (e.g., if medications were no longer being effective, or dietary changes no longer relieved bowel habits or pain):

My symptoms weren't improving in fact I think…just made it worse, you know, so I noticed a lot more. (Male, 65, stage 3)

For some, an increase in the number of additional symptoms warranted cause for concern and facilitated a GP consultation. One participant reported beginning with manageable symptoms that did not cause alarm, such as loss of appetite, however, as time progressed, additional symptoms presented and became unmanageable:

In November, a year previously, I, um started having, weight loss and loss of appetite. [Then a while later] either constipation or diarrhoea [so I] went to my local doctor. (Female, 51, stage 4)

Some participants also recognised that symptoms had become unmanageable in their daily routine, as indicated by a change in their physical ability to perform usual household tasks, manage holidays, or complete his work efficiently:

*I was going to the toilet around about 10 times a day then, and then um, it got worse. I was going 30 / 40 times a day … It was a nuisance. Like, I'd be up on the bloody roof [working, and think] Oh sh**! Down the ladder, into the portaloo – you know? (Male, 60, stage 2)*

In this interval Māori participants were more likely to consider the impact of their symptoms in relation to their families. This included overcoming their concerns about needing to accept help:

You know in the mirror and you're like that's me, because I want to feel positive aye and I want to have pride aye. You know. I have a two year old daughter that um, man I want her to look up to me like, yeah 'churr my dad' she would like that. (Male, 50, stage 3)

Disruption to work and inability to manage a daily routine were important facilitators to seeking help for both Māori and non-Māori participants, and was an indicator that self-management options were exhausted/no longer effective and that their health was in a more serious state than initially thought.

Diagnostic Interval

4. Other diagnoses

A prominent theme identified in the diagnostic interval was the participants' perception that their symptoms had been misdiagnosed, either once or multiple times. Common misdiagnoses included haemorrhoids, menopause, diverticulitis, vitamin B12 deficiency, low iron, diabetes, stress, anxiety, irritable bowel syndrome, kidney stones and food poisoning, with GPs typically prescribing medication for these:

Symptoms probably were, around about 10 months prior, um, to finally being diagnosed, and I'd been to my GP quite a few times of that 10 months period with my concerns, and his first comment was, you know 'it's probably just piles, you've probably just got piles.' And I said 'look, I've had them before, I know what pile bleeding is' … I said, 'This is quite a lot of blood'. (Female, 42, stage 3)

Other diagnoses were reported more often by participants who experienced longer diagnostic intervals (excluding those who were diagnosed incidentally) and therefore was an important barrier to prompt diagnosis.

5. Patient appraisal of GP

Participants typically appraised their GPs performance throughout the diagnostic interval. Participants universally reported a positive experience if their GP investigated symptoms proactively, leading to a prompt diagnosis. For example, some participants praised GPs for having a high level of CRC knowledge (recognising symptoms) and taking the initiative in providing healthcare (referring for colonoscopies / blood tests and calling participants for routine check-ups). One person perceived a high level of technical competence from their GP:

I did go to my GP. And um, she did some blood tests and I was extra low in iron. So she gave me some iron. Um which made me feel a whole lot better. But in, in between times, she had already written to have a colonoscopy for me to

have at [hospital]. Yeah so it's, she obviously suspected something wasn't quite right, you know, for losing all that iron out of my body so, yeah. So she then, got things cracking and she really did. (Female, 75, stage 3)

While the perception of a technically competent GP was associated with prompt diagnosis, a perceived lack of technical competence was an important barrier to diagnosis. For example, a lack of technical competence was perceived if GPs failed to perform appropriate medical examinations before offering a diagnosis:

He seemed to think I had piles, although he didn't check. He never once, he never once examined me at all. Which I thought was really odd. (Female, 51, stage 4)

In addition to the perception of technical competence, participants also assessed their GPs level of interpersonal competence based on their experiences of feeling respected, informed and cared about. Participants who reported having an overall positive diagnostic experience also perceived their GP to have a high level of interpersonal competence. Interestingly, interpersonal competence could often override perceptions about technical competence and a longer interval to diagnosis, and could still lead to a positive diagnostic experience:

He [doctor] said 'you are under my care'. And that made a big difference, because it showed that somebody actually did care. I wasn't just a number. (Female, 69, stage 4)

In contrast, a failure to demonstrate interpersonal competence generated a negative diagnostic experience:

He just didn't really care, wasn't interested and just, look-looked me up and down and just kept typing on his, on the computer. (Female, 42, stage 3)

For one person, despite having received five earlier non-cancer diagnoses, experiencing a longer interval to diagnosis and cancer progression, it was the perceived lack of interpersonal competence that had the most negative impact:

I stood at the reception and I, was actually treated quite disrespectfully, through this whole journey. Even by the receptionist because I think, I think they thought I was a hypochondriac … [So I said tell the doctor] I won't be in for my B12 shot next week because I, I'm, I don't have B12 deficiency. I have cancer. And I've never heard from them. Not an apology. Not a letter. Nope, nothing … and I just feel sorry for anybody else that's been treated by him because we were just. We were just, I, you know I, I really feel that. Um, that particular company, just, get you in and out. Here's some drugs, bugger off. We really don't care. You know? And so all through this, I actually started seeing, I went and got counselling. (Female, 51, stage 4)

Discussion

We have shed light on the barriers and facilitators experienced by CRC patients who either did or did not experience a long interval to diagnosis. For all the non-Māori symptomatic participants, the perception of an abnormal or previously unexperienced CRC symptom acted as a key facilitator to help-seeking behaviours. However, there was a barrier for some Māori participants who appraised their symptoms according to whether they were perceptible to their work colleagues or family. For all participants, self-managing and normalising symptoms acted as a barrier as no alarm was experienced. Symptoms worsening and an increasing inability to perform routine daily activities was identified as a key facilitator for the majority of symptomatic participants. This was particularly the case for Māori participants, who focused on their desire to involve their children as they made the decision to seek medical help. Other diagnoses being offered before clinical investigations, and a patient-appraised lack of GP technical competence acted as barriers to a prompt CRC diagnosis, whilst in contrast, a perceived high level of technical competence was found to be a facilitator to diagnosis. The perception of interpersonal competence was found to be a key

facilitator to diagnosis and dictated the overall positive or negative GP-patient experience.

Implications

Overall, these findings hold broader implications relating to the health promotion, health campaign, and CRC symptom education contexts in NZ. Tailoring CRC health messages and information to the non-clinical and culturally diverse audience is crucial for CRC symptoms to be recognised and diagnosed quicker, as recommended by both this report and previous literature [69, 70]. We recommend that CRC health campaigns that ask if one has anaemia will not have any contextual meaning to a non-clinical individual. Instead, this research suggests asking if one is too tired to carry out their normal daily activities, or if their routine has changed due to bowel habits, as this could be a more effective way of generating CRC symptom awareness in individuals and communities with no clinical terminology knowledge.

This 'culturally diverse' messaging should have a particular focus on Māori and Pacific groups to eliminate inequities in CRC outcomes. A further strategy to emerge from this study is to heighten GPs understanding of the complex appraisal and psychological processes patients go through before seeking a consultation to avoid colluding with incorrect interpretation of symptoms (e.g., the normalising of symptoms). Building awareness across the community would also contribute to GPs being consulted quicker. Having a medical workforce that is more appreciative of the effort it takes many patients to seek help will also make them more likely to listen to what may appear as vague symptoms. These together will enable CRC diagnosis to occur at earlier stages and likely reduce CRC deaths in NZ.

In addition, a key message is the importance of interpersonal and technical competence. Minimising the perception of a lack of technical or interpersonal competence could strengthen GP-patient relationships. Consequently, this could reduce the amount of reported complaints to the Health Commissioner about GPs failure to examine or adequately perform GP duties in the future.

Phase 3: Clinical note review

With diagnostic difficulty, it is important to understand patient and GP behaviours around a CRC diagnosis. One way to do this is to review patient-reported versus GP-recorded data, but this relies on the accuracy of patient–reported events and GP records. While often viewed as the preferable source, medical records are time-consuming to acquire from general practices and review [105, 106], and their accuracy can be affected by incomplete patient records or poor recording from GPs, who must complete clinical notes in an already pressured consultation timeframe. As such, GP records can be a poor source for estimating patient intervals – partly due to information not being accurately documented [107].

As an alternative source of data, patient-reported dates are viable tool [106] that both emphasise and allow direct measurement of the patient experience [108, 109]. Patient-reported outcomes have been shown to have reasonable accuracy [107], and are easier to collect, but as with GP records, can be affected by accuracy which is dependent on the patient's level of health literacy and memory recall [105]. Reviews of patient-reported versus GP-recorded data have shown that patients tend to over-report cancer screening [105], and specific to CRC, over-report CRC test use [110] and claims for sigmoidoscopy compared to medical records [111]. However, other research has shown good consensus between patient reports of receiving endoscopy versus medical records, although discrimination between the type of endoscopic test received was poor [112].

We report on a validation of patient-reported versus GP-recorded data as part of the final phase of a larger project investigating reducing delays to CRC diagnosis in the Midland region of NZ. We assessed the level of consensus between patients and GPs on dates of CRC diagnosis, number of GP visits prior to diagnosis, and reporting of CRC-related symptoms. It was expected that reasonable concordance would be shown between the two datasets.

Method

GP records were reviewed for 70 consenting patients from 50 GP practices, restricted to within the Waikato region due to cost and travel limitations at time of collection. GP practices were provided with copies of patient consent forms and approached for consent to release patient records. Data collected included the number of GP appointments within 12 months prior to diagnosis, specific CRC symptoms noted (e.g., COBH, rectal bleeding, abdominal pain, weight loss), date of first presentation to a GP with CRC symptoms, other symptoms listed, tests ordered and date of GP referral to secondary care (if applicable). Clinical date of diagnosis was validated against dates obtained from Waikato DHB clinical records where date of colonoscopy was recorded as the date of diagnosis.

Data analysis

Descriptive statistics were used to describe the characteristics of the study population. Raw agreement (concordance) was evaluated by percentage agreement between patient-reported and GP-recorded dates and events. Patient-reported date of diagnosis was compared to GP or hospital recorded date of diagnosis by calculating the difference between the two dates in months. Dates within the same month were coded as 1 (agreement), and dates with more than one month's difference were coded as 0 (disagreement). Percentage of consensus was then calculated. The number of patient visits to their GP in the 12 months prior to diagnosis was classified into groups as per the structured questionnaire (e.g., 1-5, 6-10, 11-15, 16-20, 20+). These were then coded (e.g., 0=0-5, 1=6+) for analysis. The number of visits were tallied from the GP-records and coded as per the

patient data and percentage agreement was calculated. From the questionnaire, patients answered yes (coded as 1) or no (coded as 0) to whether their GP referred them for colonoscopy. Whether GPs referred a patient for colonoscopy or not was extracted from GP records (where recorded) and coded as per the patient data so that percentage agreement could be calculated. The type of first reported CRC symptom, and other subsequent CRC symptoms reported by both patients and GP records were assigned a code and percentage agreement was calculated by coding agreement (1) or disagreement (0). The number of first CRC symptoms reported by patients and recorded by GPs were tallied (e.g., COBH=1, COBH and rectal bleeding =2) and compared using kappa analysis. This process was repeated for 'other' reported symptoms.

Results

Table 12 describes the characteristics of 70 patients whose GP records were reviewed. Of these patients, 87.1% were aged 60+, 67.1% were male and 91.4% were non-Māori. Just over half (52.9%) of patients reported initiating a GP consult for 'other' symptoms (e.g., weight loss, appetite loss, fatigue, anaemia, vomiting, nausea). COBH was the first patient-reported symptom for 31.4% of patients, followed by rectal bleeding by 28.6% of patients. Six (8.6%) patients reported zero CRC-related symptoms prior to diagnosis. The most common GP-ordered test was iron studies (75.7%) followed by B12 and folate (47.1%).

Table 13 shows the percentage of consensus between patient-reported and GP-recorded date of diagnosis, number of GP visits prior to diagnosis, the first CRC-related symptom and other reported symptoms. There was high agreement between all variables except first and other reported CRC symptoms.

Table 12. Patients diagnosed with CRC through 50 Waikato general practices.

Factor	n	%
Age		
<60	9	12.9
60+	61	87.1
Gender		
Male	47	67.1
Female	23	32.9
Ethnicity		
non-Maori	64	91.4
Maori	6	8.6
Mode of diagnosis		
Through investigations by a GP	49	70.0
Incidental finding	9	12.9
ED admission	10	14.3
Other	2	2.9
FIRST GP visit symptom		
COBH	22	31.4
Rectal bleeding	20	28.6
Abdominal/anal pain	15	21.4
Other	37	52.9
None	6	8.6
Number of symptoms on FIRST GP visit		
None	6	8.6
Single	43	61.4
Multiple	21	30.0
GP ordered tests		
Iron studies	53	75.7
B12 and folate	33	47.1
Ferritin	17	24.3
Faecal culture/specimen	13	18.6
None	13	18.6
Complete blood count	11	15.7
DRE (recorded)	5	7.1
CEA	6	8.6
Other (H-pylori, parasites/giardia/crypto, abdominal ultrasound)	12	17.1

Cohen's κ was used to determine if there was agreement between the number of patient-reported first and 'other' CRC symptoms and GP-recorded first and 'other' CRC symptoms. There was poor agreement between the patient and GP data for both the number of first-reported ($\kappa = .020$, $p > .05$) and 'other' CRC symptoms ($\kappa = .090$, $p > .05$).

Discussion

Patent-reported data is recognised as a viable source of data that measures events form the patient perspective [108, 109]. We have shown good agreement on dates of diagnosis, number of GP visits prior to diagnosis, and GP referrals for colonoscopy from a dataset of newly diagnosed CRC patients. These findings support other research using patient-reported data [107, 112]. However, we found poor consensus between patients and GP records on the number and type of first reported and subsequent CRC symptoms in the 12 months preceding diagnosis with 21.4% and 42.9% agreement on type of first reported and other symptoms, and a kappa score of .020 and .090 for the number of first noticed and other symptoms.

Table 13. Consensus between patient-reported and GP-recorded dates.

	Patient-GP record agreement			
	Yes	**%**	**No**	**%**
Date of diagnosis	51	72.9	19	27.1
Number of visits in the 12 months prior to CRC diagnosis	51	72.9	19	27.1
Did your GP refer for colonoscopy?	54	77.1	16	22.9
First CRC symptom	15	21.4	55	78.6
Other symptoms	30	42.9	40	57.1

Poor consensus could be due to a number of factors. Of course GPs are reliant on accurate patient disclosure, but patients must overcome several barriers which may impede this disclosure, such as a fear of tests [51, 87] and what investigations might find [113], embarrassment over discussing symptoms [34], or simply not wanting to bother the GP [51]. Patients can also downplay their own symptoms by offering self-explanations as to their cause, or may only disclose CRC-related symptoms at the end of the consult if embarrassed and under the guise of visiting the GP for another reason [103]. Poor continuity of care [37, 98], and patient recall may are other contributing factors. From the GPs perspective, clinical notes must be completed within in an already pressured consultation timeframe (typically 15 mins). As such, GP records can be a poor source for estimating patient intervals – partly due to information not being accurately documented [107].

4. Recommendations:

For the Cancer Control Agency:

1) An education campaign is needed to raise greater awareness of the signs and symptoms of colorectal cancer so that patients can be encouraged to attend their GP soon after they first notice a new symptom. These messages need to be tailored to meet the needs of Māori and other relevant groups
2) DHBs should be encouraged to put all patients who a GP considers to be at high suspicion of cancer (HSCan) onto the Faster Cancer Treatment (FCT) pathway
3) The variation in the conversion rate of referrals to DHBs being seen by a specialist should be audited to ensure there is equal access across New Zealand to care for patients at risk of cancer
4) There should be a wider investigation as to the reason for the variation in colonoscopy rates for Māori compared to non-Māori following referral
5) Consideration should be given to providing access to Faecal Immunological Testing (FIT) to GPs to help them rule out CRC in patients presenting with abdominal signs or symptoms

For health care professionals:

1) We recommend that general practices address the occurrence of diagnostic delay in their patients though the regular use of significant event reviews
2) General practices should ensure Māori patients presenting with signs and symptoms that may indicate a risk of CRC do not have undue diagnostic delay
3) GPs should consider a raised platelet count >375 10^9/L in a patient with signs or symptoms relevant to CRC to have an additional risk factor for urgent referral
4) GPs are reminded to ensure key symptoms are recorded in the electronic referral to allow for future audit

5. Further Research:

We see this study informing the next steps of research within this important field, moving into understanding the HCP perspective and most importantly, implementing an intervention that facilitates improvements in the detection period.

Why is this research important and what impact can it have?

Late diagnosis of CRC is a major contributing factor to the poor outcomes in NZers; 1200 people will die each year from CRC. Delayed diagnosis of colorectal cancer is a major cause of the unacceptably high mortality rates for CRC in NZ [6]. It is estimated that 1700 lives a year are lost in England each year due to sub-optimal care [55]. In NZ during the period 2006-2010 it is estimated that there were approximately 600 avoidable deaths for patients with CRC [65].

Our approach to researching the detection period has allowed us to identify where the greatest time intervals occur along the cancer care pathway and allow better targeting of a future intervention. This will make a significant contribution towards the goals of understanding, maintaining and enhancing health and wellbeing and understanding and reducing inequalities in risk factors and determinants for disease and injury. For instance, for delay where patients do not recognise symptoms that may be cancer related and need medical assessment we can target improved health information for the at-risk population. If GP delay is important in some cases, then there are ways of making sure these delays are reduced through practice protocols such as safety netting for patients with negative investigations but continuing symptoms [66], ensuring continuity of GP care and use of significant event reviews. Our research into the variations and use of the referral system for CRC patients is crucial in ensuring that the system facilitates early diagnosis and smooths the patient/primary/secondary care interface. Hospitals should review the HSCan label from GPs and classify these patients more urgently.

The impact of the detection period in improving outcomes from cancer is a relatively new field. Our methodology is new to NZ and has built on research from the UK and Europe [51, 52]. Making sure that Māori needs are taken into account is critical in ensuring that the known inequalities in the cancer pathway, especially within the detection period are not accentuated. For instance, it appears that the presence of co-morbidities is an important confounding influence impacting diagnosis. Māori are more likely to have co-morbidities and so signs and symptoms may be wrongly attributed to their pre-existing health issues. It will be important therefore to concentrate on making sure patients with co-morbidities are looked at more carefully. Similarly, the information needs of Māori may be different and require tailoring either in the use of language or a more culturally safe method of delivery. Our research suggests that the problem of late diagnosis for Māori is preferentially addressed.

Our research has the highlighted the characteristics throughout the detection period that influence early diagnosis to help primary care providers in assessing and managing patients at risk of CRC and in reducing clinically significant delays. The introduction of safety netting procedures has the potential to impact, not just CRC but all cancer diagnoses where symptoms are persisting.

6. Acknowledgements:

The team would like to thank and acknowledge the support for the study provided by the following:

- Gill Hunn from University of Waikato at the Waikato DHB
- Waikato District Health Board (DHB)
- The Midland Cancer Network Waikato/BOP Cancer Society
- Te Puna Oranga
- The University of Auckland
- The University of Otago
- The University of Melbourne
- The University of Edinburgh
- Health Research Council of New Zealand
- Ministry of Health
- The University of Waikato
- Mary Bradley, Bowel Cancer NZ

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8. APPENDICES

APPENDIX 1: Publications and Presentations

Publication List:

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Blackmore, T.L., Norman, K., Kidd, J., Cassim, S., Chepulis, L., Keenan, R., Firth, M., Elwood, M., Stokes, T., Weller, D., Emery, J., Lawrenson, R. Barriers and Facilitators to Colorectal Cancer Diagnosis in New Zealand: A Qualitative Study, BMC Family Practice, 2020, 21: 206.

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Firth, M., Blackmore, T., Chepulis, L., Keenan, R., Stokes, T., Weller, D., Emery, J., Lawrenson, R. Why does NZ have such poor outcomes from colorectal cancer – the problem of late diagnosis? 2021 Journal of Primary Health Care

Blackmore T., Chepulis L., Keenan, R., Kidd, J., Emery J., Weller D., Stokes T., Lawrenson R. How do colorectal cancer patients rate their GP? 2021 BMC Family Practice

Publications under review:

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Publications for submission:

Lawrenson, R, Moosa, S, Warren, J, van Dalen, R, Chepulis, L, Blackmore, T, Lao, C, Mayo, C, Kidd, J, Firth, M, Stokes, T, Elwood, M, Weller, D, Emery, J. Outcomes from colonoscopy following referral from New Zealand general practice

Presentations to conference:

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Using e-referral data to identify delays in diagnosis of colorectal cancer. GP & Primary Health Care Research Weekend, Hanmer Springs, 9th Sept 2018.

APPENDIX 2a: Sources of Data

Data was obtained from the following sources:

National Health Index number (NHI)

The NHI is a unique identifier assigned to every person who uses health and disability support services in NZ.

New Zealand Cancer Registry (NZCR)

The NZCR contains information about all malignant tumours first diagnosed in NZ (excluding basal cell and squamous cell tumours of the skin).

The Pharmaceutical Dataset (PHARMS)

The Pharmaceutical Collection contains claim and payment information from pharmacists for subsidised dispensing that have been processed by the Sector Services General Transaction Processing System (GTPS).

The collection was started in July 1992 but complete recording is only reliable after 2005. Patient data is identified by NHI and is linked to all claims from pharmacies including hospital pharmacies for all medications dispensed. Medications are classified by groupings and then by the chemical (generic) name of the active chemical ingredient. Date of dispensing and dosage are also recorded. Thus we can identify all pharmaceuticals that have been dispensed to an individual patient over a specified period.

National Mortality Collection (NMC)

The NMC is maintained by the Ministry of Health and records all deaths in NZ.

Ethnicity

Ethnicity codes were derived from the MOH ethnicity classification.

Deprivation

To assess the degree of neighbourhood deprivation, the domicile codes were mapped on to the 2013 NZ Deprivation Index (NZDep), with decile ten considered as the most deprived and decile one the least deprived.

Data Analysis

All tables were created using Microsoft Excel. All basic statistical calculations were calculated using SPSS, a statistical software package (IBM Corporation, New York, NY, USA). All survival analyses were generated using the Kaplan Meier method.

APPENDIX 2b: E-referral data, Lakes DHB

In total, 8218 patients were referred to general surgery and gastroenterology at Lakes DHB, which is proportionately greater than the number referred to Waikato DHB.

Table 1. Characteristics of Lakes patients referred.

		Frequency	Percent
Age group	30-49	2264	27.5
	50-59	1633	19.9
	60-69	1719	20.9
	>=70	2535	30.8
Sex	Male	3582	43.6
	Female	4636	56.4
Ethnicity	non-Māori	6410	78.0
	Māori	1808	22.0

Comparison with Waikato DHB findings

It should be noted that there were proportionately more referrals to Lakes DHB and a much higher proportion were accepted to be seen. The higher proportion referred may be due to more generalist services at Lakes, so the proportion of referrals relevant to colorectal conditions may have been less, or it may be a reflection of better access to general practice in Lakes compared to the Waikato. It should be noted that 18% of Waikato referrals were not seen and referred back to the GP for ongoing management, while in Lakes this was only 3%.

However, of those accepted for review, 33% of Waikato patients went on to colonoscopy while only 20.4 % of Lakes patients who were referred had a colonoscopy. This would suggest that the patients referred in Lakes were different. However the age distribution in the two samples was similar, Lakes had slightly more female patients and had a higher proportion of Māori

When it came to access to colonoscopy Māori patients in Lakes were less likely to have a colonoscopy – a similar finding to Waikato. Following colonoscopy, the findings were consistent, with an increasing risk with increasing age, a greater risk in males, and for Lakes, a slightly lesser risk in Māori, whereas in Waikato the risk in Māori and non-Māori was equivalent.

Table 2. Characteristics of those referred and accepted.

Characteristics		Not accepted		Accepted		Overall
Age group	30-49	73	3.2%	2191	96.8%	2264
	50-59	64	3.9%	1569	96.1%	1633
	60-69	47	2.7%	1672	97.3%	1719
	70+	67	2.6%	2535	97.4%	2602
Gender	Female	129	2.8%	4507	97.2%	4636
	Male	122	3.4%	3460	97.2	3582
Ethnicity	non-Māori	186	2.9%	6224	97.1%	6410
	Māori	65	3.6%	1743	96.4%	1808
Overall		251	3.1%	7967	96.9%	8218

Table 3. Characteristics of those receiving a colonoscopy

Characteristics		No colonoscopy		Colonoscopy		Overall
Age group	30-49	1877	85.7%	314	14.3%	2191
	50-59	1192	76.0%	377	24.0%	1569
	60-69	1246	74.5%	426	25.5%	1672
	70+	2026	79.9%	509	20.1%	2535
Gender	Female	3600	79.9%	907	20.1%	4507
	Male	2741	79.2%	719	20.8%	3460
Ethnicity	non-Māori	4879	78.4%	1345	21.6%	6224
	Māori	1462	83.9%	281	16.1%	1743
Overall		6341	79.6%	1626	20.4%	7967

Table 4. Conversion rate of Lakes patients who had colonoscopy

Characteristics	No CRC		Had CRC		Overall
Age group					
30-49	314	98.1%	6	1.9%	320
50-59	377	98.2%	7	1.8%	384
60-69	427	97.3%	12	2.7%	439
70+	465	89.1%	57	10.9%	522
Gender					
Female	888	96.3%	34	3.7%	922
Male	695	93.5%	48	6.5%	743
Ethnicity					
Non-Māori	1311	94.9%	70	5.1%	1381
Māori	272	95.8%	12	4.2%	284
Year of referral					
2015	643	94.4%	38	5.6%	681
2016	562	95.4%	27	4.6%	589
2017	378	95.7%	17	4.3%	395
Overall	**1583**	95.1%	**82**	4.9%	**1665**

Table 5. Adjusted odds ratio of having CRC

Factors		P-value	Odds ratio	95% Confidence interval	
Age (continuous)		<0.001	1.08	1.06	1.11
Gender	Women	Ref			
	Men	0.024	1.71	1.07	2.71
Year (continuous)		0.194	0.82	0.61	1.11
Ethnicity	Non-Māori	Ref			
	Māori	0.494	1.26	0.65	2.43
HSCAN-Hospital	No	Ref			
	Yes	0.016	2.98	1.22	7.30

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HSCAN-Hospital	No	Ref			
	Yes	0.016	2.98	1.22	7.30

APPENDIX 3

Why does NZ have such poor outcomes from colorectal cancer – the importance of the pre-diagnostic period.

Melissa Firth BSc, MHSc[1], Tania Blackmore BSocSci, MSocSci, PhD[1], Lynne Chepulis BSc, MSc, MPhil, PhD[1], Rawiri Keenan MBChB, FRNZCGP[1], Tim Stokes MA MPhil MB ChB MPH PhD FRCP FRCGP FRNZCGP[2], Mark Elwood MB, MD, DSc, FRCP (Canada), FAFPHM[3], David Weller MBBS MPH PhD FRCGP [4], Jon Emery BA BMS MA PhD[5], Ross Lawrenson MBBS, MD, FRCGP, FFPH, FAFPHM[1].

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Abstract

Introduction: Over 3000 cases of colorectal cancer (CRC) are diagnosed annually in New Zealand (NZ). The proportion of late stage diagnoses are higher than similar countries, and highest in Māori and Pacific patients. Survival outcomes are poorer than Australia and poor for Māori and Pacific. A regional screening programme is not yet available to the entire target population (60-74 years).

Aim: This study reviews research investigating the pre-diagnostic pathway for CRC in NZ and how this may contribute to poorer outcomes.

Methods: Scoping review for original articles examining the pre-diagnostic period for CRC published on the PubMed database between 2009-2019. Findings were interpreted within the Model of Pathways to Treatment framework and in context of international evidence.

Findings: 83 publications were assessed, 8 studies were included. Studies were predominantly greater than 5 years, qualitative, and focussed on screening. Facilitatory factors for the appraisal and help seeking intervals were increased CRC public awareness and the critical role of the general practitioner (GP). No specific facilitatory or inhibitory factors were identified for the diagnostic interval; however, two studies identified that time frames were not meeting national and international targets. One study identified longer pre-diagnostic intervals were associated with younger age at diagnosis.

Conclusion: Limited recent research has investigated the CRC pre-diagnostic pathway in NZ. Identification of facilitatory and inhibitory factors and implementation of appropriate strategies to improve them alongside the wider uptake of the screening programme may improve stage at diagnosis and outcomes for NZ CRC patients.

Keywords: bowel cancer, equity, primary health care

Introduction

Colorectal cancer (CRC; cancer of the colon, rectosigmoid and rectum, or bowel cancer) is common in New Zealand (NZ) with over 3000 new cases diagnosed annually[1]. Survival post-diagnosis is dependent on the extent of disease (stage) at diagnosis; ranging from a 90% 5-year relative survival rate for early stage disease (localised disease; cancerous cells confined to the colon or rectum, AJCC stage I, IIA and IIB), to 14% for late or advanced-stage disease (distant disease; cancerous cells found in other organs or distant lymph nodes, AJCC stage IV) [2]. Thus, diagnosis at an early stage (early diagnosis) and subsequent intervention are critical to ensuring positive outcomes for NZ patients.

The distribution of stage at diagnosis for NZ patients diagnosed with CRC has been published by the PIPER project; the largest study of CRC in NZ to date[3]. For colon cancer, the distribution of disease stage at diagnosis was: 12% stage I, 27% stage II, 25% stage III and 24% stage IV. For rectal cancer (reported as non-metastatic versus metastatic only) 19% had metastatic disease at diagnosis[4]. These distributions are comparable to that of a United Kingdom population without CRC screening in place[5]. Stage at diagnosis for NZ patients also varies by ethnicity, with Māori and Pacific patients having higher proportions of late-stage disease than non-Māori, non-Pacific (35%, 31% and 23% respectively).

Given the relationship between disease stage at diagnosis, survival outcomes and the poor distribution of stage at diagnosis, it follows that survival in NZ is poor among international comparisons, particularly when compared to Australia[6, 7, 8]. The CONCORD-3 study (an international comparison of 18 cancers across 71 countries), reports 5-year net survival from colon

and rectal cancer in 2010-14 as 64% and 66% respectively in NZ versus 71% for both in Australia[6]. Similar 5-year net survival rates were also recently reported from the International Cancer Benchmarking Partnership SURVMARK-2 study, ranking NZ the third worst for survival from both colon and rectal cancer out of seven countries (Australia, Canada, Denmark, Ireland, NZ, Norway and the United Kingdom)[7].

These large-scale international studies support the previous findings of NZ-based researchers who identified that between 2006 and 2010, 5-year relative survival was 5% less than in Australia[8]. Survival post-diagnosis also varies depending on patient ethnicity and socioeconomic status. The PIPER project identified significant survival disparities for Māori and Pacific patients, and for those living in areas of high deprivation[4]. When looking at survival inequities between ethnic groups, controlling for disease stage significantly reduced the disparity for Māori patients, confirming the importance of early diagnosis in this population[4].

Indicators of potential deficiencies in the pre-diagnostic pathway for CRC include diagnosis being made via emergency department (ED) presentation and obstructive disease at initial diagnosis. In the PIPER study, 31% of patients were diagnosed following ED presentation, and 19% with obstruction[4]. These indicators are worse for Māori; patients living in areas with the greatest deprivation (socioeconomic status) and rural patients[4]. A NZ report looking at national performance indicators for bowel cancer between 2013-2016 found that 26% of patients were diagnosed following presentation to ED, and that this was higher for people aged less than 50 or greater than 75 years, Māori, Pacific and those living in areas of high social deprivation, and varied by DHB[9], confirming inequalities in access to primary care and diagnostic services exist in NZ.

A staged roll out of a national bowel screening programme has been underway in NZ since July 2017, following a 6 year pilot in Waitemata DHB[10]. At the time of writing, ten out of 20 District Health Boards (DHBs) are participating (Hutt Valley, Wairarapa, Waitemata, Southern, Counties Manukau, Nelson Marlborough, Hawkes Bay, MidCentral, Whanganui and Lakes)[10]. Although this is undoubtedly a positive step forward, even with a screening programme, the majority of bowel cancers are still diagnosed symptomatically (24) and limitations to access remain, including the age band covered by the programme (60-74 years old) and disparities in participation[10]. It is important to recognise that CRC occurs across all age groups, and that there are groups of patients who are more likely to be diagnosed at a younger age, particularly Māori and Pacific[3]. A position statement from Te Ohu Rata O Aotearoa, Māori Medical Practitioners highlights that more than half of all cases of CRC occurring in Māori patients are diagnosed before age 60[11]. As they emphasise, ignoring the different distributions in age at diagnosis between populations will result in increased inequities for Māori patients diagnosed with CRC[11]. Worryingly, the incidence of CRC in patients aged less than 50 years is increasing in both the NZ population[12], and internationally[2]. Thus the known limitations of screening coverage, combined with increasing incidence in younger patients is reflected in our high rates of late stage at diagnosis and poor survival outcomes. This gives impetus to deepening our understanding of the pathway to diagnosis for NZ patients diagnosed with CRC, and what we can do to intervene. This is particularly important if we are to eliminate inequities between patient groups.

The aim of this paper is to identify and summarise research undertaken in NZ to investigate factors affecting the pre-diagnostic period for patients with CRC, which may contribute to late stage at diagnosis and poor survival.

Methods

A scoping review was conducted for published studies including NZ patients' data examining factors contributing to late stage at diagnosis. Both qualitative and quantitative studies were included. Original research articles examining the pre-diagnostic period for patients diagnosed with CRC in NZ published between 2009 and 2019 were searched for using the Pubmed central database. The pre-diagnostic period was defined as the time period between the discovery of symptoms (or receipt of the invitation letter for bowel screening) and diagnosis. A Medical Subject Heading (MeSH) term search of the Pubmed database for "Colorectal Neoplasms" was combined with additional headings or subheadings including "diagnosis" and "primary care" and "New Zealand" (see Appendix). Abstracts were reviewed for all search-resulting articles where available. Editorials, letters to the editor, and review articles were excluded. Full-text articles for all relevant studies were obtained, reviewed and data abstracted by one author (MJF). Reference lists of the full-text articles were also reviewed to identify any additional studies to be assessed for inclusion. Data was abstracted into a pre-populated proforma for each study. Results were considered within the Model of Pathways to Treatment framework, (Figure 1)[13] an internationally recognised theoretical framework for examining pathways to diagnosis. In brief, the framework considers four key intervals in the pre-treatment period: appraisal, help-seeking, diagnostic and pre-treatment. The framework allows for the consideration of contributing factors (patient, healthcare provider and systems, and disease) and their impact on the intervals as facilitating or impeding progress through the pathway[13]. For the purposes of this study focussing on diagnosis, only the first three intervals are of relevance.

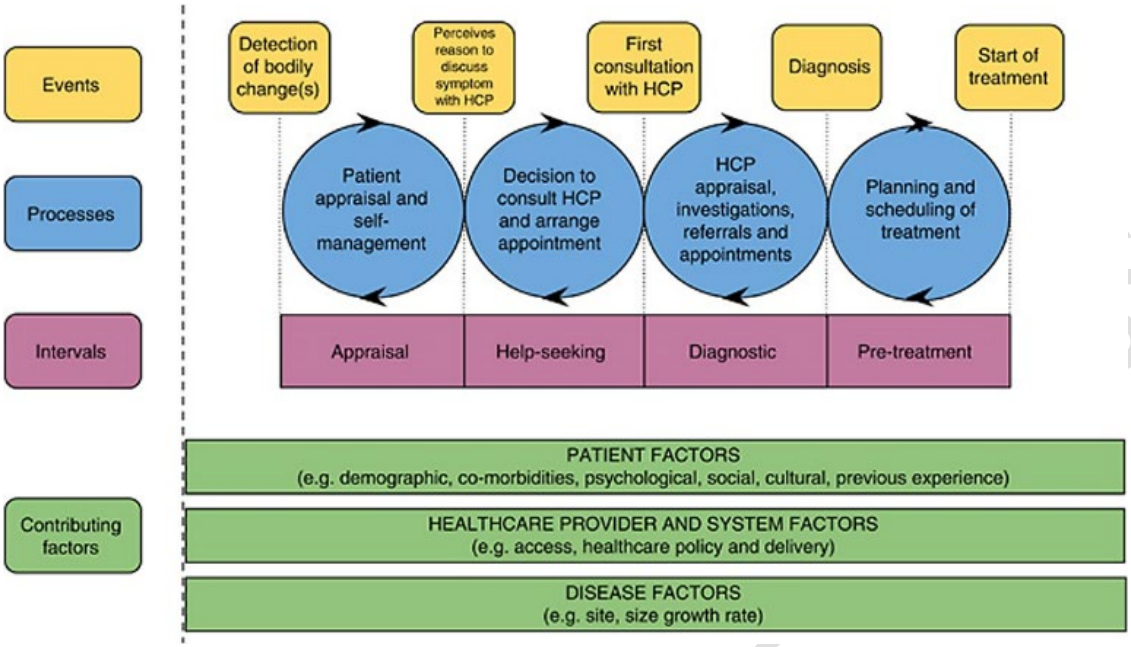

Figure 1. Model of Patient Pathways to Treatment. Reproduced from Walter F, Scott S, Webster A, Emery J. The Andersen Model of Total Patient Delay: a systematic review of its application in cancer diagnosis. J Health Services Research and Policy 2011: 1-11 (13).

Findings

Database searching yielded 83 results. Following removal of duplicate records (n=22) and 53 exclusions, 8 relevant studies were reviewed. Reasons for exclusion were (in order of most common reason): study examining post-diagnostic pathway, diagnostic test parameters or secondary care; editorial; study examining a related diagnosis; letter to editor; review article; clinical guideline document; health economics study; pharmacy based study; summary paper post conference. One search result was unable to be accessed for review and one article was identified through reference searching. Included studies were primarily qualitative (five of eight) and conducted more than 5 years ago (pre-implementation of the screening pilot). Five of the studies

addressed research questions specific to CRC screening. However, the topics explored in these studies included factors that are relevant to the appraisal, help-seeking, and diagnostic intervals, hence their inclusion in this study. Four of the studies included Māori in their study design. Table 1 summarises the studies included. Collated findings are grouped into subheadings based on the intervals of the Models of Pathways to Treatment framework.

Appraisal Interval

Studies examining perceptions to CRC screening identified the need to raise awareness of CRC in the public profile[14, 15, 16, 17]. They suggested that a multiple media source campaign to raise awareness of CRC was necessary and could also address many of the perceived inhibitory factors to screening; including patient factors surrounding reticence and concern regarding ability to collect faecal specimens, and health-system factors including perceived poor test reliability. Disease factors relating to lack of specific symptoms and perceived slow development of CRC were seen by patients as positive reasons to undergo screening. In a qualitative survey by Windner et al, 95% of participants reported being symptomatic, with 73% reporting more than one symptom. The most common 'trigger' symptom was rectal bleeding[18]. In considering the pathways within this interval, Windner et al[18] found that the majority of patients consulted someone who was not a health care professional , prior to consulting an health care professional. The first health care professional sought was a GP. The critical role of the GP in CRC diagnosis (and screening) was re-emphasised multiple times by earlier studies examining screening perceptions. No studies sought to quantify the timeframe specifically of this interval, however one study looked at timeframes that included this interval[18]. Windner et al captured self-reported symptom-to-diagnosis interval for all symptomatic patients in their cohort. This timeframe would reflect the

appraisal period + the help-seeking interval and the diagnostic interval: 25% reported <3 months; 44% <6 months and 71% <12 months. Patients aged <50 years old were statistically significantly more likely to report a symptom-to-diagnosis interval of 6 months or longer than those in the screening programme age range of 60+ years[18]. However while this study is the most recent and one of the most in-depth, it is likely not representative.

Help-seeking Interval

Windner et al directly asked questions around the help-seeking interval[18]. Disease factors identified as facilitating help-seeking behaviour were non-specific symptom concern. Conversely, an acceptable alternative benign explanation for symptoms was the most commonly identified inhibitory factor. Raising public awareness of CRC as discussed in the appraisal interval above would likely also have an impact on the help-seeking interval, as would the role and relationship with the GP. As above, no studies sought to quantify the timeframe of this interval, while recognising the challenges of measuring this interval specifically.

Diagnostic Interval

Windner et al reported 54% of participants had 0-1 and 6% had 4 or more visits with their health care professional prior to diagnosis. The two quantitative studies largely focused on this interval. Tiong et al compared their cohort to national and international targets for wait-times between referral to colonoscopy and referral to first treatment, and found that 44% and 21% met the 42 day and 62 day targets respectively. They also identified an increased pre-hospital delay (symptom onset to first specialist appointment) for patients with systemic symptoms and altered bowel habit[19]. Murray et al also report on the period between referral to first treatment, with 68% meeting

the comparative UK target of 62 days (median length 35 days)[20]. There were no significant differences between 2001 and 2005 cohorts or by ethnicity. The greatest delays in this study were seen in the interval from initial referral to first specialist appointment[20].

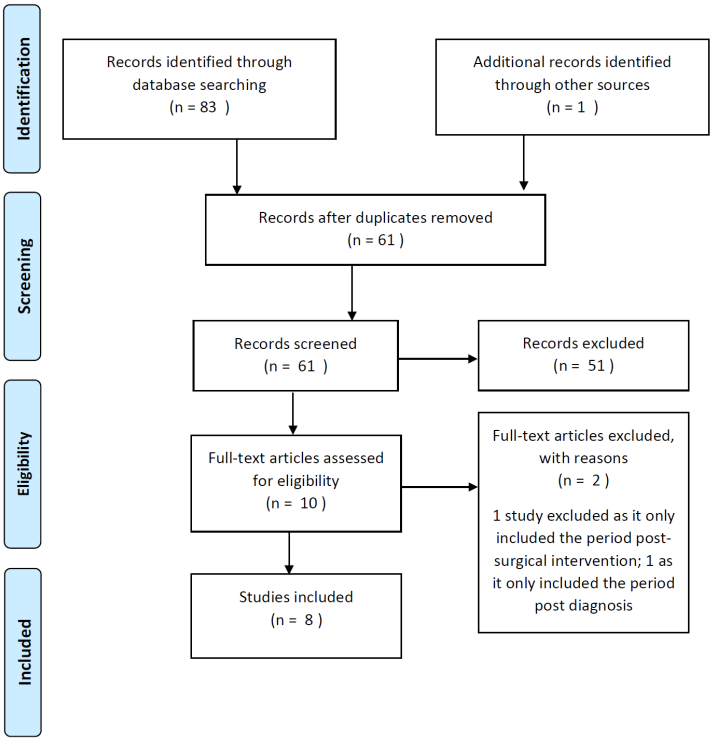

Figure 2. PRISMA 2009 diagram.

1 Table 1. Summary of included studies.

First Author, Year	Qualitative/ Quantitative	Cohort & recruitment method	Summary of methods	Summary of findings	Limitations
Windner[18] 2018	Qualitative	National, patients diagnosed with CRC (n=98) from 2007 (or earlier) to 2018, all ethnicities Recruited via national charity Bowel Cancer New Zealand (BCNZ) via Facebook, website, newsletter and newspaper	Cross-sectional questionnaire collecting info on demographics, CRC characteristics, symptoms, help-seeking, diagnostic pathways and patient experience Online administration	Young cohort (73% aged under 60), 78% female; 22% male. 85% NZ European/ Pakeha, 8% Māori , 7% other. Self-reported stage at diagnosis: I (17%), II (27%), III (46%), IV (8%) 95% reported being symptomatic; 73% reported >1 symptom. Rectal bleeding was the most common 'trigger' symptom 79% first discussed symptoms with a non-health care professional (HCP); first HCP approached was the GP (83%) highlighting the importance of general practice in the CRC diagnostic pathway Most common facilitator for help-seeking was worry about symptoms, unsure what they could represent; most common barrier to help-seeking was an	Sample not representative of general CRC population (younger age, higher proportion female, lower proportion late disease) Māori under-represented Self-reported data – not cross-referenced/ validated against clinical data e.g. stage, symptoms

				acceptable explanation of symptoms. Authors suggest this a greater awareness of CRC symptoms in the general population would be of benefit. Symptom-to-diagnosis interval was >6 months for 56% and delay was associated with younger age 54% reported 0-1 HCP visits prior to first specialist assessment (28% 2-3 visits, 6% 4+) Most common pathway to diagnosis: non-HCP approach, then GP, then specialist, leading to diagnosis	Recall bias – 22% diagnosed >5 years previous Questionnaire validation not discussed (some questions from the NZ Health Survey)
Tiong[19] 2017	Quantitative	Patients who received treatment for colonic cancer at Dunedin Hospital between 1 October 2007 and 31 September 2009 (n=141)	Retrospective clinical note review (secondary care) Reviewed length of time for components of the diagnostic pathway and benchmarked against	41% early stage; 59% advanced stage. No significant differences in age, gender or symptoms at presentation between groups Failure to meet national and international targets for timeliness: 44% met the Ministry of Health target for colonoscopy 42 days post GP referral; 21% met UK target of first treatment received within 62 days of	Retrospective data >10 years old Single centre, Small sample size Ethnicity not addressed Symptomatic only

			national and international standards. Delay classified into 4 categories: total therapeutic delay, pre-hospital delay, hospital delay, investigative delay. Symptom onset information derived from GP referral letter combined with FSA letter Comparison between groups based on stage at diagnosis: early (T1-3N0M0 and advanced (T4N0M0, TXN1-2MX, TXNXM1)	referral. However there was no difference between groups based on stage Overall found no evidence of an association between cancer stage and long wait times Change in bowel habit and systemic symptoms were associated delays in the symptom onset to GP referral interval and the symptom onset to FSA interval The advanced group had increased utilisation of private and emergency investigations	Exclusion of pathway post-acute admission Detail regarding identification of patients/ cross-reference to the NZ Cancer Registry missing

Thompson [14] 2012	Qualitative	NZ European/ Pakeha and Māori residents of Auckland, Wellington and Christchurch (n=80) Recruited via GP practice (flyers on notice board) and through personal networks and the bowel cancer registry	In-depth face-to-face interviews Topic guide: knowledge of and attitudes to current screening programmes, experience and understanding of CRC, impressions and experiences of the different types of CRC screening and what might encourage their participation in a CRC screening programme Māori interviewer available	"Invisibility of CRC" identified as "extremely important to address". Suggested this is due to the likely combination of lack of or sporadic information and the perception that its "something you don't talk about" Faith in the potential of screening programmes to benefit health, however the belief that the introduction of screening is based on advocacy/ lobbying (as opposed to consideration of biological evidence) and thus skewed to women's cancers Both men and women identified that participation of males may be more difficult, due to: perceived marginalization of men's health; perception of women's responsibility in ensuring men access health services; and concepts of masculinity including help-seeking as being "weak" (emphasised for Māori males), preserving bodily boundaries/ invasion of rectal area and sexuality. Authors conclude that normalisation of men's help-seeking in a wider context is required to improve update of screening in NZ males.	Focus on screening

			Thematic analysis		
Pitama[15] 2012	Qualitative	Māori (self-identifying) employees of Māori heath providers in Auckland, Wellington, Christchurch and New Plymouth (n=30)	Semi-structured face-to-face interviews incorporating kaupapa Māori research methodologies with a Māori interviewer Topic guide: perceptions of current screening programmes, knowledge of CRC, knowledge, opinions and potential barriers of/to CRC screening Content analysis to identify key themes	Age range 40-66; 80% female, 20% male Lack of knowledge of CRC and screening (particularly noteworthy due to cohort being health provider employees) Reported lack of CRC health promotion, and health education literature Pivotal role for GP. Facilitating factors included a positive GP-patient relationship (includes cultural competency and quality communication) and GP 'buy-in' to the value of the screening programme Role in the Māori community for Māori health workers to advocate for CRC screening	Focus on screening Cohort are all actively engaged in the health care system – non-representative sample
Bong[16] 2011	Qualitative	Chinese ethnicity	In-depth face-to-face interviews conducted by a Chinese	Median age 56, 60% female, 40% male. Six (24%) had previously had a screen for CRC	Focus on screening

		Recruited via public information notices at informal Chinese community organisations and churches (n=25)	interviewer in Chinese (Mandarin) and English in a private and convenient room Semi structured format. Themes included CRC signs and symptoms, previous CRC screening experience, perceived seriousness of CRC, GP and family influence on CRC screening	Traditional Chinese beliefs about health and good self-care along with diet and a lack of awareness around CRC and its seriousness were inhibitory in engaging in screening. A personal or family experience or noticed change in bowel habit was facilitatory GPs were highly regarded and recommendation to undergo screening from a GP with a robust explanation of the test and reasoning was highly facilitatory	Paper did not detail how ethnicity was identified e.g. self and what area of NZ patients were from Authors noted that the lack of a gender matched interviewer combined with the sensitive nature of CRC symptoms and screening procedures may have compromised the information given by male participants
Reeder[17] 2011	Qualitative	NZ European residents of Auckland, Wellington and Christchurch, aged 50-71 & eligible for the proposed	In-depth face-to-face interviews primarily conducted at home. Topic-guide – no pre-set questions including general	Median age 59, 60% female, 40% male A low awareness/ public profile of CRC exists and a high-profile, mixed media public education campaign is necessary to achieve acceptable participation	Focus on screening NZ European only (Māori reported separately) Urban only

		screening programme (n=50)] Recruited via flyer on GP notice board	information regarding screening programmes & CRC and summary information regarding CRC screening methods and FOBT (faecal occult blood testing) Recorded, transcribed verbatim, pragmatic analysis approach guided by a published 4 domain framework of perceived factors influencing FOBT screening participation	Key factors to promote participation and acceptance are building normative support and perceived self-efficacy to take the test Key potential barriers to be addressed included test specificity/ perceived poor test reliability; anxiety about false positives and negatives and resulting possible unnecessary colonoscopies General practices identified as effective routes to promote and deliver FOBT	
Abel[21] 2011	Qualitative	GPs, general surgeons, gastroenterologists and medical	In-depth, semi-structured interviews	Support for population-based screening in theory Concerns regarding: capacity/ resourcing, particularly around colonoscopies but also around primary care	Focus on screening

		oncologists from Auckland, Wellington and Christchurch (n=26) Recruitment "selected purposively for inclusion to reflect the diversity of socioeconomic patient lists"	Topics: thoughts on population based screening programme, the surveillance guidelines for CRC, screening, advise to patients at different levels of risk for CRC and referrals for colonoscopy Thematic analysis	capacity to 'manage' the screening programme; increasing patient anxiety and accuracy of FOBT. Colonoscopy was the preferred screening test of choice, with FOBT being considered to have low sensitivity and specificity GPs seen as key for communication/delivery of information regarding CRC risk and discussion of screening	Participant identification method not clear Discussion regarding FOBT was not differentiated between guaiac and immunochemical (improved sensitivity and specificity)
Murray[20] 2011	Quantitative	Patients diagnosed with colorectal adenocarcinoma in the calendar years 2001 and 2005 in the Auckland region (n=1128) Patients identified through the NZ	Retrospective study, clinical note review Data extracted: demographics, disease characteristics, comorbidities, symptoms (recorded at referral and FSA),	Median age 70, 49% female, 51% male. NZ European 68%, Māori 4%, other 20%. Stage at diagnosis: Dukes A 13%, B 34%, C 41%, metastatic 23% Abdominal pain was the common symptom documented (44%) Most common pathway to diagnosis was GP referral (68%) to FSA general surgery	Retrospective data >10 years old Small sample size for non-European ethnicities limits ability to make comparisons between groups

		Cancer Registry, 3 regional District Health Board (DHB) databases (Auckland, Counties-Manukau and Waitemata) and private clinicians databases	referral details, dates and types of diagnostic tests and interventions Duration of 5 time intervals from initial referral to initial management calculated Descriptive statistics, comparisons between groups	Majority of patients had a colonoscopy and this increased over time (56% in 2001 and 74% in 2005) Median time from initial referral to first treatment was 35 days. There were no significant differences between the two year cohort or by ethnicity 85% were treated within 31 days of diagnosis and 68% were treated within 62 days from initial referral (UK benchmarks). The greatest delays were seen in the interval from initial referral to FSA	Pathological definition of diagnosis resulted in negative values for some groups of patients

Discussion

This study identified limited research has been undertaken in NZ patients with CRC examining the pre-diagnostic period and its relationship to late diagnosis. The majority of studies are nearly 10 years old. The studies repeatedly highlighted the need for increased public awareness of CRC in NZ to assist self-appraisal, help-seeking and screening participation. They also emphasised the fundamental role GPs and primary health play in a CRC diagnosis and in facilitating screening. Qualitative studies demonstrated a failure to meet national and international targets for timeliness, particularly when looking at the period from referral to first specialist appointment, diagnosis or treatment; although delays were not shown to be associated with late-stage diagnosis. A comprehensive mixed methods approach including analysis of timeframes and qualitative assessment of factors influencing these timeframes has not been undertaken by any one study. Plenty of gaps exist in our understanding of patient, health care provider, system and disease factors that facilitate or inhibit the pathway to diagnosis for patients diagnosed with CRC in NZ. This study also highlights the lack of information on Māori and Pacific populations, who have poorer outcomes.

Such research is being conducted internationally. The International Cancer Benchmarking Partnership is a collaboration to explore population and healthcare-related factors affecting cancer survival outcomes between Australia, Canada, Denmark, Norway, Sweden and the UK[22]. Published work to date has investigated: (i) Primary Care Physician-reported access to investigations, timeliness of test results and wait for secondary care specialist assessment and the readiness of Primary Care Physician s to investigate or refer to secondary care following symptoms indicative of cancer[23]; and (ii) diagnostic routes and time intervals from first symptom to initiation of treatment[24]. Both topics were assessed for differences between the six included countries and subsequent possible impact on reported survival figures. These large-

scale studies identified a suggested correlation between readiness to refer or investigate suspected cancer symptoms for CRC and survival[23] and that wide variations in time intervals exist between the countries, suggesting that improvements could be made in expediting diagnoses[24], but; were unable to identify any correlation between greater time intervals and survival (i.e. countries with poorer survival did not consistently have longer time intervals) [24]. The authors of both studies express the need for more detailed examination and understanding of factors affecting readiness to refer (including changing access to investigations, quality and utility of clinical guidelines, relationship with secondary care) [23] and length of time to diagnosis (noting that in many cases a longer period included multiple investigations) [24].

Many factors influencing the pre-diagnostic pathway are likely to be population and health-system-specific. NZ was not included in the above studies. However, a 2014 NZ study used the International Cancer Benchmarking Partnership survey instrument to survey 192 GPs in regard to a range of cancer types and found that NZ GPs have poor access to colonoscopy compared to other jurisdictions (all considered to have similar, primary-care led health services to NZ) [25]. This work also suggested that NZ GPs are less likely to refer patients at risk of CRC, although could not address why this may be. Perhaps poorer access to colonoscopy means that GPs are more reluctant to refer and apply a higher threshold before referring for colonoscopy. The critical role of the GP and the primary health sector was highlighted by several studies included in this review, and is identified by the Ministry of Health as being 'key' in the success of the bowel screening programme[10]. Accordingly, we urge that it is imperative to support and facilitate GPs in the CRC pre-diagnostic pathway more effectively, through improving our knowledge and understanding of the current inhibitory factors that exist, and implementing evidence-based changes to mitigate these factors and improve timely diagnosis for all patients.

Perceived delay in CRC diagnosis is of importance to the NZ patient. The 2015 Health and Disability Commissioner report on delayed diagnosis of cancer in primary care indicated that delays in diagnosing CRC were one of the biggest causes of complaint, and over-represented when compared to its incidence in the population[26]. This report analysed all complaints to the Health and Disability Commssioner between 2004-2013 of issues relating to delayed diagnosis of cancer by GPs[26]. Of 197 complaints, 54 (27%) pertained to a diagnosis of CRC[26]. The report suggests that the most common issue for complaints regarding CRC related to non-specific or atypical presentation of symptoms[26]. However, a lack of appropriate examination where symptoms were present was significantly associated with delayed CRC diagnosis[26]. For 72% of the CRC cases reviewed, the outcome was death or terminal illness, further emphasising impact of the known late stage of diagnosis of CRC in NZ[26]. Worryingly the report found that the total number of cancer complaints made to the Health and Disability Commissioner over the 10 year period significantly increased from 2004 to 2013[26]. Although this report is now 5 years old, it is likely that similar issues still exist, as evidenced by a 2019 article from the Associate Commissioner Jane King in NZ Doctor, describing a case seen four times over a nine-month period, initially for perianal itch and irritation, progressing to rectal bleeding and change in bowel habit[27]. Failure to conduct a rectal examination and insufficient clinical records were found by the Health and Disability Commissioners clinical advisor to be a breach of the NZ code of Health and Disability Consumers' Rights[27]. Clear pathways and interventions, based on a knowledge of facilitatory and inhibitory factors to diagnosis, along with adequate support and prompt and appropriate follow-through from the secondary care sector are needed to support the primary sector in this crucial role.

The authors are currently undertaking a Health Research Council-funded project utilising both quantitative and qualitative research methods to examine the pre-diagnostic period for patients

diagnosed with CRC in the Midland region of NZ. We hope that this research will identify where the greatest barriers are along the pre-diagnostic period, to drive targeted interventions to reduce late stage diagnosis of CRC in NZ patients. Given the critical role of the GP in the CRC pre-diagnostic pathway, we believe it is imperative that any such research, along with any subsequent potential interventions, be disseminated to and include input from colleagues working in the primary care sector.

Conclusions

There is a paucity of recent data examining the pre-diagnostic period for patients in NZ diagnosed with CRC. Given the known poor distribution of stage at diagnosis and survival outcomes by international comparisons, inequities in stage at diagnosis and survival outcomes by ethnicity, limitations of the current screening programme, differing age distributions for Māori and Pacific populations, and increasing rates of CRC diagnosis at younger ages; it is imperative that we seek to understand how we can improve stage at diagnosis, via thorough examination of the pre-diagnostic pathway and implementation of facilitatory factors. Work to date highlights the critical role of the GP in this pathway, and the need for carefully designed and evaluated public awareness campaigns for CRC.

What gap this fills

What we already know:

- Survival from CRC in NZ is lower than in Australia and varies depending on ethnicity and socioeconomic status.
- Survival is correlated with stage at diagnosis. Late stage at diagnosis results in decreased survival. Correcting for stage at diagnosis in ethnic subgroups accounts for the majority of the survival disparity.
- Previous studies have shown the distribution of stage at diagnosis for patients with CRC in NZ is worse than other countries. Indicators of advanced stage at diagnosis or late diagnosis including presentation to ED and emergency surgery are higher in NZ.
- National benchmarking identifies regional, ethnic and age-based variation in routes of diagnoses for CRC in NZ.
- Although CRC screening is gradually being implemented around NZ, this only includes 60+ year olds and an increasing number of patients in NZ and worldwide are being diagnosed with CRC at a younger age. This also affects populations with younger age distributions at diagnosis (e.g. Māori and Pacific) disproportionally.
- Thus we need to address the question of how we can improve stage at diagnosis for all patients, regardless of being eligible for screening or not.

What this study adds:

- There are few published studies undertaken in the NZ population to investigate factors affecting the pre-diagnostic period and late diagnosis in patients diagnosed with CRC. The majority of these are qualitative, do not explore stage and were undertaken greater than 5 years ago.
- There is a lack of information regarding Māori and Pacific populations.

- The authors of this paper are currently undertaking a large study to address the gaps in our knowledge of the pre-diagnostic period and its impact on late diagnosis in the NZ population. The importance of such work is reinforced by large scale international collaborations examining the diagnostic pathway for CRC.
- Raising public awareness of CRC in general and CRC screening is necessary. GPs are identified as being facilitatory in this step and critical to the diagnostic pathway for NZ patients.

Competing interests

The authors declare no competing interests.

Funding

This study was supported by the Health Research Council of New Zealand (HRC grant number 17/147).

Acknowledgements

MJF wrote the main manuscript. All remaining authors edited and reviewed the manuscript.

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The characteristics and outcomes of patients with colorectal cancer in New Zealand, analysed by Cancer Network

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ABSTRACT

AIM: The incidence of colorectal cancer (CRC) in New Zealand is high by international standards. Approximately 1,200 people in New Zealand die from this disease per year. Outcomes in New Zealand following a CRC diagnosis are poor. We aimed to describe the characteristics and outcomes of patients diagnosed with CRC across the four regional cancer networks in New Zealand.

METHOD: Patient demographics, tumour characteristics and survival outcomes for all patients diagnosed with CRC between 2006 and 2015 were analysed retrospectively from the National Cancer Registry (NZCR) and National Mortality collection and were linked by National Health Index (NHI) number.

RESULTS: A total of 29,221 CRC cases were recorded during the 10-year study period, of which the majority were cancer of the colon (67.9%). In this sample, 42.0% were >75 years, 52.1% were male and 88.1% were New Zealand European. After adjustment for factors such as age, gender, ethnicity year of diagnosis, cancer extent, cancer grade, lymph node and cancer site, cancer-related and all-cause survival were not significantly different by cancer network for those aged <75 but for patients aged >75 years, those living in the Central and Midland Cancer Network had a higher risk of dying of CRC compared to those in the Northern Cancer Network (1.12, 95% CI: 1.03–1.22 and 1.10, 95% CI: 1.02–1.18 respectively). Overall, Māori and Pacific people had worse cancer-specific and all-cause survival than New Zealand European.

CONCLUSION: No regional variations were seen within New Zealand for the characteristics and survival outcomes of patients <75 diagnosed with CRC. The risk of dying from CRC increased for those >75, which is supportive of the international literature regarding outcomes for the elderly and CRC. We continue to show disparity in outcomes for Māori and Pacific patients diagnosed with CRC in New Zealand.

Colorectal cancer (CRC) is the second most common cancer in New Zealand.[1] Almost 3,500 new cases were registered in New Zealand in 2018, with around 1,200 deaths.[2] The incidence of CRC in New Zealand is high by international standards; the GLOBOCAN age-standardised estimated incidence rate shows Australia and New Zealand as having the highest rates of CRC in the world.[2] Outcomes in New Zealand are poor; five-year survival rates in New Zealand following a CRC diagnosis are lower than Australia.[3–5] Stage of disease at diagnosis, Māori ethnicity, deprivation level and rate of presentation to hospital emergency departments[5,6] are contributing factors associated with poorer outcomes.

Worldwide, a higher incidence of CRC occurs in those aged 70 years or more.[7–9] Increasing levels of comorbidity[7,10–13] together with higher risk of functional and cognitive impairment[12] contribute to poorer outcomes for elderly compared to younger patients. Higher rates of comorbidity and increasing frailty results in older patients being less likely to access treatment,[11,14–16]

ISSN 1175-8716

have higher rates of emergency surgery and have significant risk of mortality at 90 days post-surgery.[17] An assessment of cancer survival in seven high-income countries from 1995–2014 demonstrated an increase in age standardised five-year net survival in New Zealand for both colon and rectal cancer in those aged <75, but a decrease for those aged >75 diagnosed with colon cancer.[18] Thus, New Zealand data are supportive of the international literature, where poor survival is noted with increasing age, particularly for those aged 80 and over[8,16,19] with little improvement over time despite advances in treatment options.

New Zealand is divided into four regional cancer networks: the Northern, Midland, Central and Southern Cancer Networks. Within these regional networks are several district health boards (DHBs) that provide for the health needs of the local population: the Northern Cancer Network covers the Northland, Auckland, Counties Manukau and Waitemata DHBs, the Midland Cancer Network covers Waikato, Lakes, Bay of Plenty and Tairawhiti, and the Central Cancer Network encompasses Taranaki, Whanganui, MidCentral, Hawke's Bay, Wairarapa, Hutt Valley and Capital and Coast DHBs. The Southern Cancer Network encompasses the whole of the South Island. This study aimed to quantify the outcomes of patients diagnosed with CRC in New Zealand using national databases across these four regional networks.

Method

This study retrospectively reviewed patients diagnosed with CRC (ICD-10-AM codes C18–C20) in New Zealand between 01 January 2006 and 31 December 2015. Eligible patients were identified from the New Zealand Cancer Registry (NZCR). Their mortality information was obtained from the Mortality Collection and linked by National Health Index (NHI) number.

The combined dataset consisted of: 1) patient demographics: date of birth, gender, ethnicity and district health board (DHB); 2) tumour characteristics: date of diagnosis, cancer site, cancer extent and number of positive lymph nodes; and 3) date of death and cause of death. Age at diagnosis was categorised into five groups: <55, 55–64, 65–74, 75–84 and 85+ years. Ethnicity was classified into New Zealand European, Māori, Pacific, Asian and others as recorded on the NZCR using prioritisation to manage multiple ethnicities. Patients were grouped into one of the four cancer networks based on their domicile: Central, Midland, Northern or Southern Cancer Network. The NZCR records cancer stage and uses both the Tumour Node Metastases (TNM) staging system[20] and the Surveillance Epidemiology and End Results (SEER) programme of cancer staging definitions.[21] Complete SEER staging was recorded for 81% of CRC patients.

Patient and tumour characteristics were compared between the four cancer networks and the differences were examined with Chi-square tests. Patients were considered to be censored on the date of death or the last updated date of Mortality Collection, which was 31 December 2015. Survival analyses were stratified by patients aged less than 75 years and patients aged 75 years or over. The Kaplan-Meier method was used to estimate the colorectal cancer-specific survival and all-cause survival by cancer network. A Cox proportional hazards model was used to estimate the hazard ratios of colorectal cancer-specific survival and all-cause survival by cancer network after adjustment for ethnicity, gender, year of diagnosis, cancer extent, cancer grade, lymph node and cancer site. All data analyses were performed in IBM SPSS statistics 25 (New York, US). The study was approved by the Health and Disability Ethics Committee (HDEC) –17/NTB/156.

Results

Patient and tumour characteristics by cancer network are shown in Table 1. In the 10-year period, 2006–2015, 29,221 people were diagnosed with CRC in New Zealand. Of these, 52.1% of patients were male. Overall, 88.1% were New Zealand European and only 5.4% were Māori. The Midland Cancer Network had the highest proportion of Māori patients (8.7% vs 2.7–6.0%), the Northern Cancer Network had the highest proportion of Asian (6.6% vs 1.0–2.0%) and Pacific patients (4.8% vs 0.3–1.7%), while the Southern Cancer Network was 95% New Zealand European. Patients in the Central and the Midland Cancer Network were younger and less likely to be diagnosed at age >75 years (33.3% and 34.0%, p<0.001)

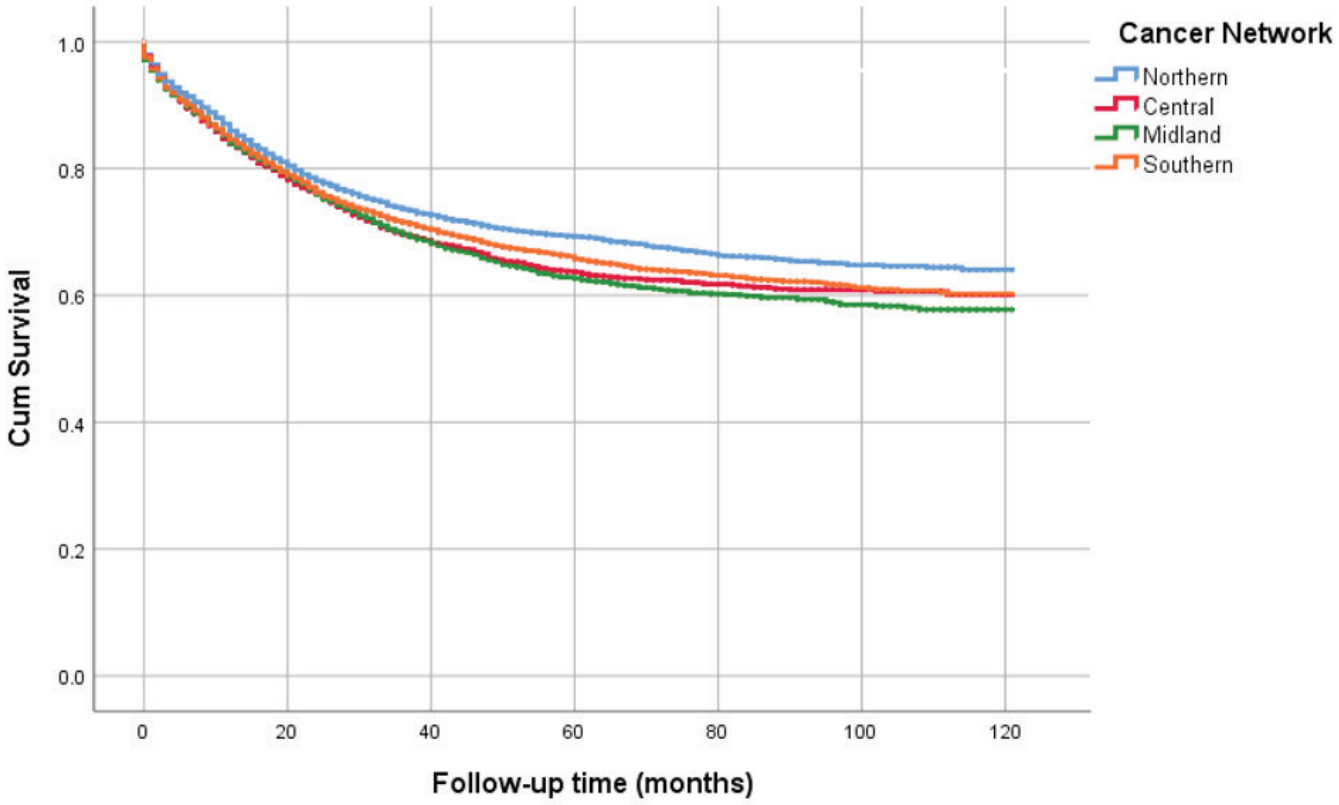
Table 1: Patient and tumour characteristics by Cancer Network.

Characteristics	Central		Midland		Northern		Southern		P-value	Unknown		Total	
Gender													
Female	2,778	48.6%	2,886	47.8%	4,112	46.8%	4,201	48.7%	0.065	25	43.1%	14,002	47.9%
Male	2,941	51.4%	3,156	52.2%	4,665	53.2%	4,424	51.3%		33	56.9%	15,219	52.1%
Ethnicity									<0.001				
Asian	116	2.0%	67	1.1%	575	6.6%	83	1.0%		3	5.2%	844	2.9%
European	5,078	88.8%	5,336	88.3%	7,093	80.8%	8,205	95.1%		39	67.2%	25,751	88.1%
Māori	344	6.0%	523	8.7%	493	5.6%	229	2.7%		1	1.7%	1,590	5.4%
Pacific	99	1.7%	31	0.5%	421	4.8%	29	0.3%		10	17.2%	451	1.5%
Others	82	1.4%	85	1.4%	195	2.2%	79	0.9%		5	8.6%	585	2.0%
Age group									<0.001				
<55	669	11.7%	644	10.7%	1,169	13.3%	838	9.7%		12	20.7%	3,332	11.4%
55–64	929	16.2%	947	15.7%	1,591	18.1%	1,460	16.9%		18	31.0%	4,945	16.9%
65–74	1,644	28.7%	1,795	29.7%	2,534	28.9%	2,735	31.7%		17	29.3%	8,725	29.9%
75–84	1,743	30.5%	1,946	32.2%	2,446	27.9%	2,576	29.9%		9	15.5%	8,720	29.8%
85+	734	12.8%	710	11.8%	1,037	11.8%	1,016	11.8%		2	3.4%	3,499	12.0%
Cancer site									<0.001				
C18	3,884	67.9%	4,191	69.4%	5,810	66.2%	5,919	68.6%		40	69.0%	19,844	67.9%
C19	336	5.9%	411	6.8%	699	8.0%	562	6.5%		2	3.4%	2,010	6.9%
C20	1,499	26.2%	1,440	23.8%	2,268	25.8%	2,144	24.9%		16	27.6%	7,367	25.2%
Extent									<0.001				
B	1,261	28.2%	1,544	30.7%	2,122	29.6%	1,997	28.2%		9	19.1%	6,933	29.1%
C	778	17.4%	801	15.9%	1,307	18.2%	1,281	18.1%		10	21.3%	4,177	17.5%
D	1,291	28.9%	1,476	29.3%	2,075	28.9%	1,996	28.2%		15	31.9%	6,853	28.8%
E	1,141	25.5%	1,216	24.1%	1,677	23.4%	1,816	25.6%		13	27.7%	5,863	24.6%
F	1,248		1,005		1,596		1,535			11		5,395	
Grade									<0.001				
1	238	5.0%	577	11.4%	1,317	19.0%	460	7.0%		9	20.9%	2,601	11.1%
2	3,610	75.7%	3,503	69.2%	4,550	65.6%	4,517	68.7%		27	62.8%	16,207	69.3%
3	861	18.1%	896	17.7%	852	12.3%	1,524	23.2%		6	14.0%	4,139	17.7%
4	59	1.2%	88	1.7%	215	3.1%	75	1.1%		1	2.3%	438	1.9%
Unknown	951		978		1,843		2,049			15		5,836	
Lymph nodes									0.115				
No positive nodes	1,964	55.9%	2,206	56.8%	3,212	57.4%	3,232	58.4%		20	52.6%	10,634	57.3%
Positive nodes	1,549	44.1%	1,678	43.2%	2,381	42.6%	2,303	41.6%		18	47.4%	7,929	42.7%
Unknown	2,206		2,158		3,184		3,090			20		10,658	
Total	**5,719**		**6,042**		**8,777**		**8,625**			**58**		**29,221**	

C18: Malignant neoplasm of colon,
C19: Malignant neoplasm of rectosigmoid junction
C20: Malignant neoplasm of rectum
Extent
B: Localised to organ of origin
C: Invasion of adjacent tissue or organ
D: Regional lymph nodes
E: Distant
F: Unknown

Figure 1: Colorectal cancer-specific survival by cancer network: (a) <75 years (p=0.000); (b) ≥75 years (p=0.005).

a)



b)

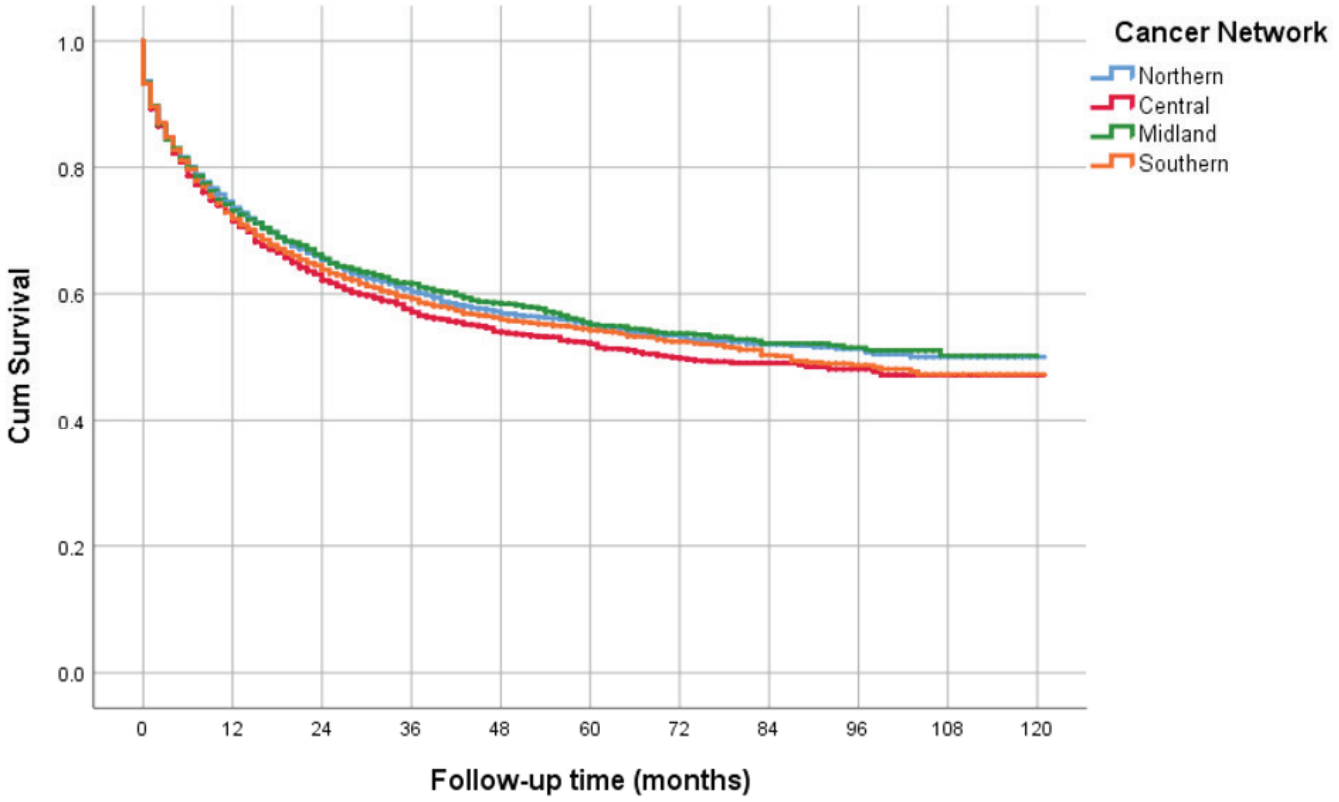


Figure 2: All-cause survival by cancer network: (a) <75 years (p=0.000); (b) ≥75 years (p=0.114).

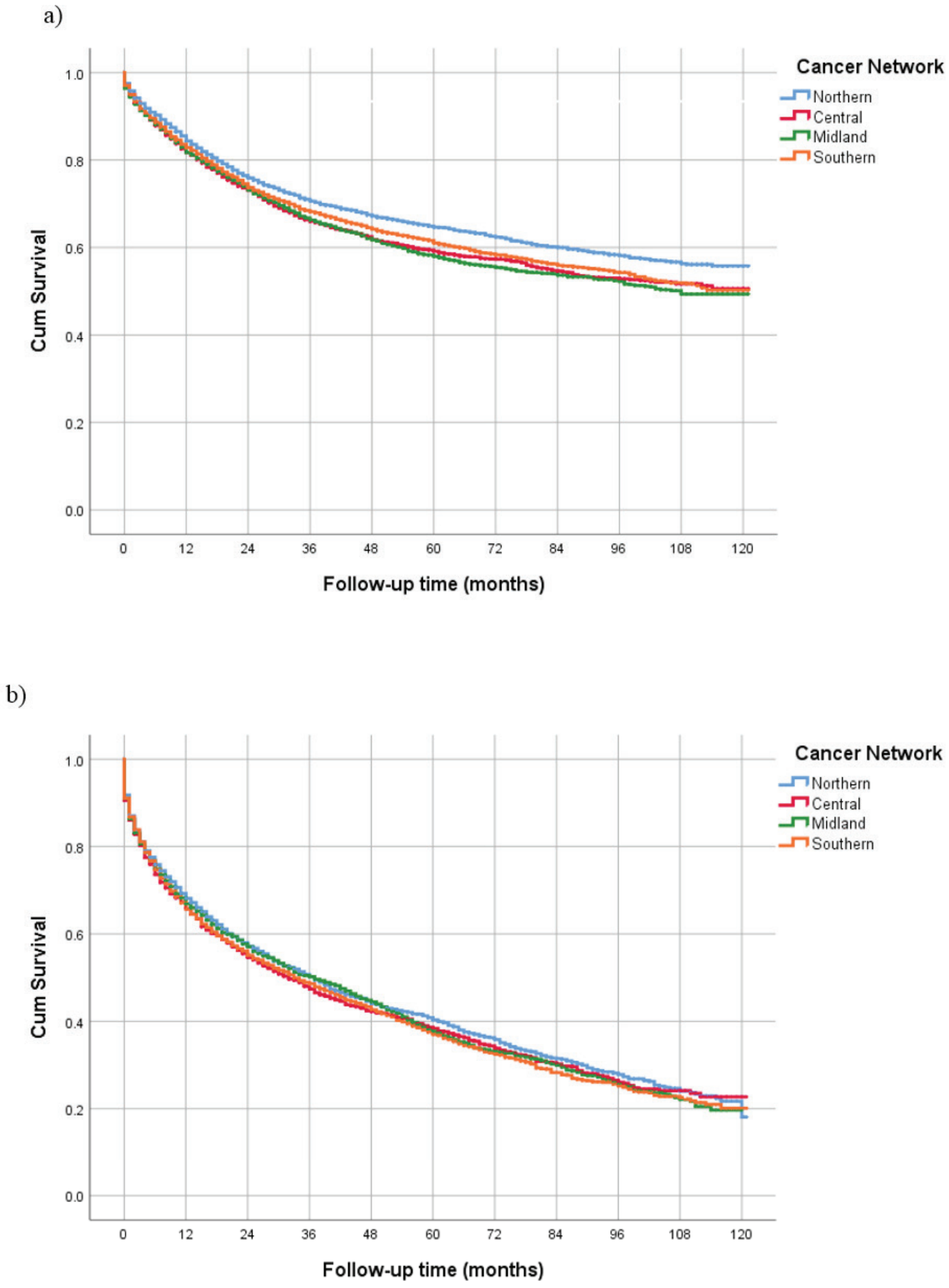


Table 2: Hazard ratios for cancer-specific mortality and all-cause mortality for patients aged <75.

	Cancer-specific mortality				All-cause mortality			
Factors	**p-value**	**Hazard ratio**	**95% CI**		**p-value**	**Hazard ratio**	**95% CI**	
			Lower	**Upper**			**Lower**	**Upper**
Age (continuous)	<0.001	1.02	1.01	1.02	<0.001	1.02	1.02	1.03
Ethnicity								
European	Ref				Ref			
Māori	<0.001	1.30	1.18	1.43	<0.001	1.41	1.30	1.54
Pacific	0.170	1.12	0.95	1.31	0.027	1.18	1.02	1.37
Asian	0.001	0.73	0.60	0.88	<0.001	0.69	0.58	0.83
Others	<0.001	0.35	0.25	0.49	<0.001	0.30	0.22	0.42
Gender								
Female	Ref				Ref			
Male	0.003	1.09	1.03	1.16	<0.001	1.13	1.07	1.19
Year (continuous)	<0.001	0.94	0.93	0.95	<0.001	0.95	0.94	0.96
Cancer Network								
Central	0.330	1.04	0.96	1.13	0.082	1.07	0.99	1.16
Midland	0.452	1.03	0.95	1.12	0.306	1.04	0.96	1.12
Northern	Ref				Ref			
Southern	0.052	0.93	0.86	1.00	0.147	0.95	0.89	1.02
Extent								
B	Ref				Ref			
C	<0.001	2.92	2.43	3.52	<0.001	1.75	1.53	2.00
D	<0.001	4.46	3.74	5.31	<0.001	2.42	2.11	2.77
E	<0.001	21.84	18.67	25.55	<0.001	10.83	9.67	12.12
Grade								
1	Ref				Ref			
2	0.011	1.17	1.04	1.33	0.028	1.13	1.01	1.26
3	<0.001	2.16	1.90	2.46	<0.001	1.96	1.75	2.20
4	0.008	1.57	1.12	2.21	0.002	1.60	1.18	2.16
Lymph node								
No positive nodes	Ref				Ref			
Positive nodes	<0.001	1.69	1.48	1.93	<0.001	1.45	1.29	1.63
Cancer site								
C18	Ref				Ref			
C19	0.043	0.90	0.81	1.00	0.043	0.91	0.83	1.00
C20	<0.001	0.71	0.66	0.77	<0.001	0.71	0.67	0.77

C18: Malignant neoplasm of colon,
C19: Malignant neoplasm of rectosigmoid junction
C20: Malignant neoplasm of rectum
Extent
B: Localised to organ of origin
C: Invasion of adjacent tissue or organ
D: Regional lymph nodes
E: Distant
F: Unknown

Table 3: Hazard ratios for cancer-specific mortality and all-cause mortality for patients aged ≥75 years.

	Cancer-specific mortality				All-cause mortality			
Factors	**p-value**	**Hazard ratio**	**95% CI**		**p-value**	**Hazard ratio**	**95% CI**	
			Lower	**Upper**			**Lower**	**Upper**
Age (continuous)	<0.001	1.04	1.04	1.05	<0.001	1.06	1.05	1.06
Ethnicity								
European	Ref				Ref			
Māori	0.564	1.06	0.88	1.27	<0.001	1.29	1.12	1.49
Pacific	0.026	1.35	1.04	1.75	0.020	1.32	1.04	1.66
Asian	0.030	0.76	0.60	0.97	0.011	0.77	0.63	0.94
Others	0.001	0.45	0.27	0.73	<0.001	0.36	0.23	0.55
Gender								
Female	Ref				Ref			
Male	0.572	1.02	0.96	1.08	<0.001	1.12	1.06	1.17
Year (continuous)	<0.001	0.96	0.95	0.97	<0.001	0.97	0.96	0.98
Cancer Network								
Central	0.006	1.12	1.03	1.22	0.016	1.09	1.02	1.17
Midland	0.098	1.07	0.99	1.17	0.008	1.10	1.02	1.18
Northern	Ref				Ref			
Southern	0.892	1.01	0.93	1.09	0.256	1.04	0.97	1.11
Extent								
B	Ref				Ref			
C	<0.001	2.46	2.10	2.88	<0.001	1.39	1.26	1.53
D	<0.001	3.81	3.19	4.55	<0.001	1.99	1.75	2.27
E	<0.001	13.18	11.32	15.36	<0.001	5.81	5.24	6.43
Grade								
1	Ref				Ref			
2	<0.001	1.33	1.15	1.54	0.002	1.17	1.06	1.30
3	<0.001	1.94	1.66	2.26	<0.001	1.56	1.39	1.75
4	<0.001	1.94	1.47	2.56	0.002	1.48	1.16	1.89
Lymph node								
No positive nodes	Ref				Ref			
Positive nodes	<0.001	1.42	1.22	1.65	0.030	1.14	1.01	1.29
Cancer site								
C18	Ref				Ref			
C19	0.136	0.91	0.80	1.03	0.046	0.90	0.81	1.00
C20	<0.001	0.80	0.73	0.86	<0.001	0.78	0.73	0.83

C18: Malignant neoplasm of colon,
C19: Malignant neoplasm of rectosigmoid junction
C20: Malignant neoplasm of rectum
Extent
B: Localised to organ of origin
C: Invasion of adjacent tissue or organ
D: Regional lymph nodes
E: Distant
F: Unknown

than patients in the Northern and Southern Cancer Network (39.7% and 41.7%, p<0.001). Patients in the Central Cancer Network were more likely to have rectal cancer (C20: 26.2% vs 23.8–25.8%, p<0.001) than the other cancer networks. Patients in the Northern Cancer Network had more grade 1 cancer (19.0% vs 5.0–11.4%), but more grade 4 cancer (3.1% vs 1.1–1.7%) than other regions (p<0.001). The proportion of patients reporting positive lymph nodes were similar across the four cancer networks.

The observed regional difference in survival was greater in patients under 75 years than in patients aged 75 years or older (Figures 1 and 2). Patients aged less than 75 years in the Northern Cancer Network had the best survival: five-year cancer-specific survival of 69.2% (67.7–70.6%) and five-year all-cause survival of 64.9% (63.4–66.3%); while their counterparts in the Midland Cancer Network had the worst survival: five-year cancer-specific survival of 62.9% (61.0–64.8%) and five-year all-cause survival of 58.3% (56.4–60.2%). For patients aged 75 years or older, the five-year all-cause survival between the four cancer networks was similar (p=0.114) (Figure 2B) while there were small differences in cancer-specific survival between regions (Figure 1B).

Cancer-specific survival and all-cause survival improved over time for both patients under 75 years and patients aged 75 years or older, after adjustment for other factors (Tables 2 and 3). The risk of dying of CRC and the risk of dying from other causes both increased with age. Men under 75 years were more likely to die of CRC compared to women, but men aged 75 years or older had a similar risk. For patients aged under 75 years, Māori had the highest hazard ratio of cancer-specific mortality (1.30, 95% CI: 1.18–1.43) and the highest hazard ratio of all-cause mortality (1.41, 95% CI: 1.30–1.54) compared to New Zealand European (Table 2). However, for patients age 75 years or older, Pacific patients had the highest hazard ratio of cancer-specific mortality (1.35, 95% CI: 1.04–1.75) and the highest hazard ratio of all-cause mortality (1.32, 95% CI: 1.04–1.66) compared to New Zealand European (Table 3). After adjustment in a multivariate analysis for other factors (age, ethnicity, gender, year of diagnosis, cancer extent, cancer grade, lymph node and cancer site), the differences in the cancer-specific mortality and all-cause mortality for patients aged less than 75 years between the four cancer networks disappeared. However, for patients aged 75 years or older, those resident in the Central and Midland Cancer Network had a higher risk of dying of CRC compared to patients in the Northern Cancer Network (1.12, 95% CI: 1.03–1.22 and 1.10, 95% CI: 1.02–1.18 respectively). For both cancer-specific mortality and all-cause mortality for patients under 75 years and patients aged 75 years or older, the risk was higher in patients with colon cancer, patients with more extensive cancer, patients with higher grade of cancer and patients with positive lymph nodes.

Discussion

New Zealand has high rates of CRC, and poorer outcomes compared to International Cancer Benchmarking Partnership (ICPB) and GLOBOCAN data.[2,18] After adjustment for patient and tumour factors, there was no significant difference in survival between regions for those aged <75, but for those aged >75 there were small regional differences.

Cancer-specific and all-cause mortality increased with age. Poor CRC survival with increasing age has been reported internationally,[8,16,19] and is attributed to higher levels of functional limitation[12] and multi-comorbidity in older patients.[7,10,11] Patients aged <75 and living in the Northern Cancer Network had the best five-year all cause and cancer-specific survival, and patients living in the Midland Cancer Network had the worst. However, after adjustment for patient and tumour-related factors these regional variations were no longer important. One important factor was that although Māori only account for 5.4% of cases, outcomes for Māori are poor, with an unadjusted HR for cancer-specific survival of 1.3 and all-cause survival of 1.41 in patients <75. The Midland region had the highest proportion of Māori and this may account for some of the disparity in outcomes. Another factor was tumour characteristics. The Midland region also had a greater proportion of colon cases. Cancer-specific outcomes for rectal cancer were 20% better than outcomes for colon cancer. Thus after adjustment for a number of patient and tumour factors, including

ethnicity and tumour location, we can see that the impact of the health services in each region seems to result in equitable outcomes, especially for those <75.

Māori and Pacific patients <75 had worse all-cause and cancer-specific survival than New Zealand European. Historically, Māori have a lower incidence of CRC compared to New Zealand European,[22–24] but this incidence has been rising.[5] Our data are consistent with poorer health outcomes often observed in Māori and Pacific cancer patients in New Zealand[6,25–28] and is in line with reported survival rates of indigenous and ethnic minority populations in other countries.[23,29–32] Of interest was the finding that in the over 75 year age group, while Pacific patients had poorer survival (OR 1.35) compared with New Zealand European, outcomes for Māori were similar (OR 1.06). Factors contributing to the ethnic disparities seen in New Zealand cancer care are well documented; Māori experience more inequalities/barriers when accessing health services than non-Māori,[27,28] experience a lower level of care from those services[26] and do not get the same access to treatment.[33] Māori and Pacific patients are also more likely to present with metastatic disease,[6,28,34,35] experience delays to diagnosis[6] and present to the emergency department compared to non-Māori /non-Pacific patients.[6] Disease biology and culture (eg, diet, help-seeking behaviour),[27] deprivation level,[6] and higher levels of comorbidity for Māori and Pacific patients[6,28,31,33,36] are also factors that contribute to these disparities.

Strengths/limitations

The New Zealand Cancer Registry (NZCR) is a large, population-based register of all cancer registrations in New Zealand. Accuracy of the demographic data in the NZCR is high.[37] Combining with data from the Mortality Collection increases the robustness of the dataset used. However, a limitation of this study was that we were unable to access surgical and other treatment data, which was missing from the dataset. It would be worthwhile to evaluate whether CRC outcomes also differ with regard to treatment in future studies.

Conclusions

No regional variations were seen within New Zealand for the characteristics and survival outcomes of patients <75 diagnosed with CRC. However, the risk of dying from CRC increased for those >75, which is supportive of the international literature regarding outcomes for elderly patients. We continue to show disparity in outcomes for Māori and Pacific patients diagnosed with CRC in New Zealand.

Competing interests:
Nil.

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URL:
www.nzma.org.nz/journal-articles/the-characteristics-and-outcomes-of-patients-with-colorectal-cancer-in-new-zealand-analysed-by-cancer-network

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APPENDIX 5

Outcomes from colonoscopy following referral from New Zealand general practice

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Word count: (excluding title page, abstract, refs, figures, tables) =2728

Abstract

Objectives To identify what proportion of patients having a colonoscopy in the Waikato District Health Board (DHB) have an underlying colorectal cancer (CRC), the factors associated with the likelihood of this diagnosis, and to determine differences in colonoscopy rates between different population sub-groups.

Design Retrospective analysis.

Setting/participants Patients referred to general surgery, gastroenterology or direct to colonoscopy from 01 January 2015 to 31 December 2017 in the Waikato region of New Zealand.

Primary and secondary outcome measures. The proportion and characteristics of patients who were having colonoscopy, and of those, who were diagnosed with CRC.

Results. 6,718 patients had a colonoscopy and 372 (5.5%) were diagnosed with CRC. Older patients (p-value<0.001), females (p-value<0.001), non-Māori (p-value<0.001), and patients with a general practitioner (GP) or hospital high suspicion of cancer label (HSCan) were more likely to have a colonoscopy. The odds ratio of Māori having a colonoscopy was 0.66 (95% CI: 0.60-0.73). The odds ratio of being diagnosed with CRC was 1.05 (95% CI: 1.04-1.06) for each additional year of age, 1.67 (95% CI: 1.35-2.07) for men compared to women, and 2.34 (95% CI: 1.70-3.22) and 2.43 (95% CI: 1.18-5.02) for a GP and hospital HSCan label respectively.

Conclusions If a GP identifies a high risk of cancer then the likelihood of a positive colonoscopy is almost 15%, suggesting that these patients could be routinely prioritised without further triage. Further research is needed to understand why Māori are less likely to receive a colonoscopy following referral from general practice.

Keywords colorectal cancer, colonoscopy rates, general practice, high suspicion of cancer

Article summary

Strengths and limitations of this study

This study aimed to identify what proportion of Waikato District Health Board (DHB) patients who undergo colonoscopy have an underlying colorectal cancer (CRC), the factors associated with the likelihood of this diagnosis, and the differences in colonoscopy rates between different population sub-groups.

All patients referred to general surgery, gastroenterology or direct to colonoscopy from 01 January 2015 to 31 December 2017 in the Waikato region of New Zealand were retrospectively analysed.

We present outcome data on over 6000 colonoscopy cases following referral from general practitioners (GPs).

We did not have complete data on symptoms or other pathology found at colonoscopy.

INTRODUCTION

Most patients with colorectal cancer (CRC) are diagnosed following a referral to hospital from a general practitioner (GP).[1, 2] Each year, approximately 1200 people in New Zealand (NZ) die of CRC.[3] Symptoms can include: blood mixed with the stool; change in bowel habit (for at least six weeks); abdominal pain or bloating; weight loss and anaemia.[4] Patients with these symptoms usually present to their GP who will arrange investigations and referral to specialist services.[5] In NZ GPs are asked to follow regional guidelines for specialist referral of patients with signs and symptoms of bowel cancer. More recently direct access referral has been made available for colonoscopy – again within strict guidelines.[6] With 3100 new cases of CRC each year,[3] on average the 3700 NZ GPs will see less than one new case per year –consistent with United Kingdom (UK) figures.[7] Referral from general practice for a diagnosis of suspected bowel cancer and colonoscopy is a relatively rare event. A Dutch study of 140,000 patients suggested only 2% were referred for investigation of suspected CRC in a 5 year period.[8] What has not been widely reported is what proportion of patients referred for colonoscopy have an underlying cancer. In the NZ screening pilot[9] first round there were 212 new cancers found after 4500 colonoscopies, or 4.7%. In a small study of 144 symptomatic patients with constipation from South Africa, it was found that 9/144 (6.25%) had an underlying colorectal cancer.[10] In Koning's general practice study only 2% (57/2785) of the patients who had a colonoscopy were diagnosed with CRC.[8]

Increasing age, male gender, a family history and a raised BMI are recognised risk factors for CRC.[11] A personal history of adenomatous polyps or inflammatory bowel disease also increases risk.[12] CRC in NZ occurs less frequently in Māori compared to non-Māori.[13] In certain defined circumstances such as persistent rectal bleeding or a change in bowel habit GPs can indicate a High Suspicion of Cancer (HSCan) and under current guidelines these patients should be seen urgently within 2 weeks. However under the NZ HSCan guidelines these referrals have to be triaged by the hospital specialist services who make the final decision as to whether the referral is deemed high suspicion or can be considered for semi-urgent or routine follow up.

The Waikato District Health Board (WDHB) has a population of 400,000 and is located in the North Island of NZ. Twenty three percent of the population identify as Māori. While generally all referrals are reviewed to see whether they will be offered as First Specialist Assessment, for patients who have clear cut symptoms and are in the appropriate age range since 2016 GPs in the region have been able to make a direct referral for colonoscopy. However, these patients also require the approval of a specialist before a colonoscopy is arranged. The DHB has 75 general practices and it has been noted that the referral rates from practices vary greatly. It has been postulated that there is a correlation between referral rates and the risk of underlying pathology e.g., high referrers may have a lower positivity rate. It has been noted in the UK that using routine data on detection and conversion rates of different GPs should be interpreted with caution and is altered by the case mix of patients presenting.[14] The aim of our study is to identify what proportion of patients having a colonoscopy in the Waikato DHB have an underlying colorectal cancer, the factors associated with the likelihood of this diagnosis, and to determine differences in colonoscopy rates between different population sub-groups.

METHODS

The population investigated were patients referred to general surgery, gastroenterology or direct to colonoscopy at the WDHB from 01 January 2015 to 31 December 2017. The extracted dataset includes patient's age, gender, ethnicity, date of referral, whether the patient had colonoscopy, whether it was direct access colonoscopy, whether the general practice was a high referrer (practices were either labelled above the median or below the median referral rate), GP label of HSCan, and the hospital label of HSCan after triage of the referral. This dataset was then linked to the National Cancer Register through the National Health Index (NHI) number to identify any cancer diagnosis for the referred patients from 01 January 2015 to 31 December 2018. The NHI number is a unique identifier for people who use health and disability services in NZ. Ethical approval was obtained from the Health and Disability Ethic Committee of New Zealand (Approval Number: 17/NTB/156).

We first analysed the characteristics of patients who were having colonoscopy and compared these to the characteristics of patients who had no colonoscopy. The difference was examined with a Chi-square test. Logistic regression was used to estimate the adjusted odds ratio and the 95% confidence interval (CI) of the odds ratio for these factors in the likelihood of colonoscopy.

We then analysed which patients were diagnosed with CRC among those having a colonoscopy. The characteristics of patients who had CRC were compared to patients who had did not have CRC. Logistic regression was used to estimate the adjusted odds ratio for these factors in the likelihood of a CRC diagnosis. Cancer extent was described by colon cancer and rectal cancer. All data analyses were performed in IBM SPSS statistics 25 (New York, United States).

Patient and Public Involvement

No patient involved.

RESULTS

During the study period, 20,648 patients were referred to general surgery, gastroenterology or direct to colonoscopy and 6,718 patients had a colonoscopy (Table 1). The probability of having a colonoscopy increased with age (p-value<0.001). Female patients were slightly more likely to have a colonoscopy than male patients (33.6% vs 31.2%, p-value<0.001), and non-Māori patients were more likely to have a colonoscopy than Māori patients (33.9% vs 23.7%, p-value<0.001). Patients with a GP label of HSCan or hospital label of HSCan were more likely to have a colonoscopy than those without the labels.

Table 1. Characteristics of patients referred.

Characteristics		**No colonoscopy**		**Had colonoscopy**		**p-value**	**Overall**
Age group	30-49	4415	78.0%	1244	22.0%	**<0.001**	5659
	50-59	2829	67.2%	1381	32.8%		4210
	60-69	2829	60.6%	1843	39.4%		4672
	70+	3857	63.2%	2250	36.8%		6107
Gender	Female	7483	66.4%	3790	33.6%	**<0.001**	11273
	Male	6447	68.8%	2928	31.2%		9375
Ethnicity	Non-Māori	11759	66.1%	6044	33.9%	**<0.001**	17803
	Māori	2171	76.3%	674	23.7%		2845
Year	2015	4936	68.1%	2315	31.9%	**0.250**	7251
	2016	4488	66.8%	2235	33.2%		6723
	2017	4506	67.5%	2168	32.5%		6674
High referrer	Low	4709	67.0%	2321	33.0%	**0.290**	7030
	High	9221	67.7%	4397	32.3%		13618
HSCan-GP	Yes	522	47.2%	585	52.8%	**<0.001**	1107
	No	13408	68.6%	6133	31.4%		19541
HSCan-Hospital	Yes	221	48.8%	232	51.2%	**<0.001**	453
	No	13709	67.9%	6486	32.1%		20195
Overall		**13930**	**67.5%**	**6718**	**32.5%**		**20648**

As shown in Table 2, after adjustment for age, gender, year of referral, whether the GP practice was a high referrer, GP label of HSCAN, hospital label of HSCAN and interaction term (HSCan-GP x HSCan-Hospital), the odds ratio of Māori patients having a colonoscopy was 0.66 (95% CI: 0.60-0.73). The adjusted odds ratio of the GP practice being a high referrer in having a colonoscopy was 0.94 (95% CI: 0.88-1.00). The adjusted odds ratio of a GP label of HSCan and hospital label of HSCan in having a colonoscopy was 2.22 (95% CI: 1.92-2.56) and 1.74 (95% CI: 1.26-2.42), respectively. After adjustment, gender and year of referral did not have a significant impact on having a colonoscopy or not.

Table 2. Adjusted odds ratio of having a colonoscopy.

Factors		P-value	Odds ratio	95% Confidence interval
Age	(continuous)	<0.001	1.01	(1.01 -1.02)
Gender	Female	Ref		
	Male	<0.001	0.87	(0.82 -0.93)
Year	(continuous)	0.707	0.99	(0.96 -1.03)
Ethnicity	Non-Māori	Ref		
	Māori	<0.001	0.66	(0.60 -0.73)
High referrer	Low	Ref		
	High	0.048	0.94	(0.88 -1.00)
HSCan-GP	No	Ref		
	Yes	<0.001	2.22	(1.92 -2.56)
HSCan-Hospital	No	Ref		
	Yes	<0.001	1.74	(1.26 -2.42)
Interaction term	(HSCan-GP x HSCan-Hospital)	0.009	0.57	(0.37 -0.87)

Among the patients who had a colonoscopy, 372 (5.5%) of them were diagnosed with CRC (Table 3). The probability of having CRC increased with age, from 1.5% of patients aged 30-49 years to 9.6% of patients aged 70+ years (p-value<0.001). Male patients were more likely to have CRC than female patients (7.1% vs 4.3%). Among patients who had a colonoscopy, 14.7% of patients with a GP label of HSCan were diagnosed with CRC compared to 4.7% of patients who had no GP label of HSCan (p-value<0.001), and 17.2% of patients with a hospital label of HSCan were diagnosed with CRC compared to 5.1% of patients who had no hospital label of HSCan (p-value<0.001). The proportion of patients who had CRC was similar by ethnicity, year of referral, whether it was direct access colonoscopy, and whether the GP practice was a high referrer.

After adjustment for age, gender, ethnicity, year of referral, whether it was direct access colonoscopy or not, whether the GP practice was a high referrer or not, hospital label of HSCan and interaction term, the odds ratio of a GP label of HSCan in being diagnosed with CRC was 2.34 (95% CI: 1.70-3.22). The adjusted odds ratio of a hospital label of HSCan in being diagnosed with CRC was 2.43 (95% CI: 1.18-5.02). The odds ratio of age (for each additional year) and gender (men compared to women) in being diagnosed with CRC was 1.05 (95% CI: 1.04-1.06) and 1.67 (95% CI: 1.35-2.07), respectively (Table 4). There was no difference in the risk of an underlying CRC for Māori compared to non-Māori or for high referrers compared to low referrers.

Of the 372 cancer patients, 269 (72.3%) had colon cancer and 103 (27.7%) had rectal cancer (Table 5). Of the colon cancer patients, 106 (39.4%) had localised cancer, 28 (10.4%) had invasion of adjacent tissue or organs, 61 (22.7%) had positive regional lymph nodes, 44 (16.4%) had distant metastases and 30 (11.2%) had unknown stage. Of the rectal cancer patients, 16 (15.5%) had localised cancer, 2 (1.9%) had invasion of adjacent tissue or organs, 15 (14.6%) had positive regional lymph nodes, 12 (11.7%) had distant metastases and 58 (56.3%) had unknown stage.

Table 3. Characteristics of patients who had a colonoscopy.

Characteristics		No colorectal cancer		Had colorectal cancer		P-value	Overall
Age group	30-49	1225	98.5%	19	1.5%	<0.001	1244
	50-59	1335	96.7%	46	3.3%		1381
	60-69	1753	95.1%	90	4.9%		1843
	70+	2033	90.4%	217	9.6%		2250
Gender	Female	3627	95.7%	163	4.3%	<0.001	3790
	Male	2719	92.9%	209	7.1%		2928
Ethnicity	Non-Māori	5710	94.5%	334	5.5%	0.904	6044
	Māori	636	94.4%	38	5.6%		674
Year	2015	2207	95.3%	108	4.7%	0.056	2315
	2016	2095	93.7%	140	6.3%		2235
	2017	2044	94.3%	124	5.7%		2168
Direct colonoscopy	No	2261	93.9%	148	6.1%	0.104	2409
	Yes	4085	94.8%	224	5.2%		4309
High referrer	Low	2202	94.9%	119	5.1%	0.285	2321
	High	4144	94.2%	253	5.8%		4397
HSCan-GP	No	5847	95.3%	286	4.7%	<0.001	6133
	Yes	499	85.3%	86	14.7%		585
HSCan-Hospital	No	6154	94.9%	332	5.1%	<0.001	6486
	Yes	192	82.8%	40	17.2%		232
Overall		**6346**	**94.5%**	**372**	**5.5%**		**6718**

Table 4. Adjusted odds ratio of having colorectal cancer.

Factors		P-value	Odds ratio	95% Confidence interval
Age	(continuous)	<0.001	1.05	(1.04 -1.06)
Gender	Female	Ref		
	Male	<0.001	1.67	(1.35 -2.07)
Year	(continuous)	0.606	1.04	(0.90 -1.19)
Ethnicity	Non-Māori	Ref		
	Māori	0.067	1.40	(0.98 -2.01)
High referrer	Low	Ref		
	High	0.814	1.03	(0.82 -1.29)
Colonoscopy	FSA and Colonoscopy	Ref		
	Direct colonoscopy	0.564	0.94	(0.75 -1.17)
HSCan-GP	No	Ref		
	Yes	<0.001	2.34	(1.70 -3.22)
HSCan-Hospital	No	Ref		
	Yes	0.016	2.43	(1.18 -5.02)
Interaction term	(HSCan-GP x HSCan-Hospital)	0.342	0.65	(0.27 -1.57)

Table 5. Cancer site and cancer extent of CRC patients.

Cancer type	Number	Percentage
Colon cancer	**269**	**72.3%**
Localised to organ of origin	106	39.4%
Invasion of adjacent tissue or organs	28	10.4%
Regional lymph nodes	61	22.7%
Distant metastases	44	16.4%
Unknown	30	11.2%
Rectal cancer	**103**	**27.7%**
Localised to organ of origin	16	15.5%
Invasion of adjacent tissue or organs	2	1.9%
Regional lymph nodes	15	14.6%
Distant metastases	12	11.7%
Unknown	58	56.3%
Total	**372**	

DISCUSSION

Colonoscopy is a common diagnostic procedure in patients referred to general surgery or gastroenterology, with 32.5% of patients undergoing the procedure. Thus approximately 1.6% (6346/400,000) of patients residing in the Waikato DHB in a three year period underwent colonoscopy. This is similar to the 2% found in the Netherlands, although the proportion who were found to have CRC in our sample was greater. Older patients and those who had an HSCan label were more likely to receive a colonoscopy. This is unsurprising as we know the risk of pathology increases with age and if the clinical picture suggests cancer then these patients should be prioritised. There was a small and probably clinically insignificant difference in the rate of cases accepted for colonoscopy after referral from high referrers. This may be due to different risk indicators in patients referred by high referrers. After adjustment for other factors, Māori were 34% less likely to have a colonoscopy. While Maori have a lower incidence of CRC than non-Māori, the size of the difference was surprising and needs further investigation. We know that there are differences in the treatment of Māori patients with CRC[15] and this would indicate that these differences extend to the diagnostic pathway.

This study has shown that the conversion rate for CRC following colonoscopy in patients referred from GPs to specialist public hospital care is 5.5%. This is similar to the conversion rate found in the national screening pilot where patients underwent colonoscopy following a positive Faecal Immunological Test (FIT).[9] This does not mean that 94.5% are negative, as a significant proportion of patients will have adenoma or other relevant pathology - as was found in the screening program.[9] It has been shown that the use of FIT can help rule out CRC in patients presenting in primary care with symptoms.[16] Thus it is possible that even greater efficiency could be gained in the diagnostic pathway for symptomatic patients which would free up colonoscopy facilities for screening purposes. When considering the underlying likelihood of CRC being found, age was obviously a significant factor with a steep rise in risk with age from 1.5 % in younger patients to 9.6% of patients 70+ years having CRC. Men were much more likely to have CRC with 7.1% conversion rate compared with women at 4.3%. These findings support the guidance for referral. However we know that there is also an increase in the incidence of CRC in younger patients in NZ[17] and if cases are not to be missed it may still be worthwhile offering colonoscopy to younger patients in order to exclude cancer. While there was no difference in the likelihood of Māori undergoing colonoscopy having CRC (5.6% vs 5.5% in non-Māori) we know the incidence of CRC in Māori is reported to be less than in non-Māori. If Māori rates of colonoscopy were similar to non-Māori we may find that the positivity rate would fall in line with the known lower incidence of CRC in Māori. The characteristics of the general practice where patients were registered did not seem to influence the conversion rate – thus those patients referred for direct colonoscopy did not differ, and there was no difference in the rate of high referrers compared to low referrers. However if the GP had indicated an HSCan and a colonoscopy was carried out, then the conversion rate was 14.7%. While the rate in those deemed an HSCan by the hospital specialist team was higher at 17.2%, this was based on only 232 cases. One could argue that the sensitivity and specificity of a GP identification of an HSCan is such that all these patients should be offered an urgent colonoscopy. The poor outcomes in NZ from CRC have been linked to late diagnosis and any opportunity to expedite a diagnosis rapidly could be considered worthwhile.

Strengths and limitations.

A study strength is that we have outcome data on over 6000 colonoscopy cases following referral from GPs. This includes data on both patient and GP characteristics. A weakness is that there was a large percentage of missing stage data, particularly for rectal cases. We also did not have complete data on symptoms and our outcome data only includes a diagnosis of CRC derived from the Cancer Registry. Therefore we did not have information on other pathology found at colonoscopy.

Implications.

The implications of these findings for policy include the need for the NZ bowel cancer guidelines to reassess the use of the HSCan and two week wait rule for patients deemed at high suspicion of cancer by their GP. We would argue that all patients deemed at high risk by their GP should be offered timely colonoscopy and that further delay by a further triage step in the referral pathway is unnecessary. We also believe that it is timely for NZ to review their guidelines for diagnosis in the light of the UK NICE guidance[18] and introduce the option of a FIT test in general practice to help rule out the need for referral for colonoscopy. Finally, given the poor outcomes for Māori following a diagnosis of CRC, the finding of a lower use of colonoscopy in Māori needs further research to better understand the reasons for this difference compared to non-Maori.

CONCLUSIONS

Almost six percent of colonoscopies in symptomatic patients referred by general practitioners result in a finding of colorectal cancer. The likelihood of cancer increases with age and is greater in men. If the GP identifies a high risk of cancer then the likelihood of a positive colonoscopy is almost 15%, suggesting that these patients could be routinely prioritised without the need for further triage. Further research is needed to understand why Māori are less likely to receive a colonoscopy following referral from general practice.

Acknowledgements
We would like to thank the Waikato District Health Board and the National Cancer Register for provision of the data.

Author contributions
RL wrote the main manuscript. CL and SM conducted the data analysis. TB prepared the manuscript for publication. All remaining authors edited and reviewed the manuscript.

Funding
This work was supported by the Health Research Council of New Zealand (HRC grant number 17/147).

Competing interests
The authors declare no competing interests.

Patient consent for publication
Not required.

Ethics approval
Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee (Ethics ref: 17/NTB/157). Patients were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Provenance and peer review.
Not commissioned, externally peer reviewed.

Data availability statement
The data analysed for the current study are not publically available for ethical reasons. All data relevant to the study are included in the article. Anonymised data can be made available from the corresponding author on request.

Open access

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APPENDIX 6

Health Service Research

Patient-reported diagnostic intervals to colorectal cancer diagnosis in the Midland region of New Zealand: a prospective cohort study

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Running title: Patient-reported diagnostic intervals to colorectal cancer diagnosis

Key messages

- NZ patients newly diagnosed with CRC experience long diagnostic intervals
- Young patients, Māori, and female patients experience long intervals
- Changes in bowel habit are also associated with longer time to diagnosis
- We need to increase CRC symptom awareness for patients and general practice

Abstract

Background and objectives: New Zealand (NZ) has high rates of colorectal cancer (CRC) but low rates of early detection. The majority of CRC is diagnosed through general practice, where lengthy diagnostic intervals are common. We investigated factors contributing to diagnostic interval in a cohort of patients newly diagnosed with CRC.

Methods: Patients were recruited from the Midland region and interviewed about their diagnostic experience using a questionnaire based on a modified Model of Pathways to Treatment framework and SYMPTOM questionnaire.

Results: Data from 184 symptomatic patients were analysed, of which, 66 (35.9%) experienced a GP diagnostic interval >120 days. These patients were more likely to be Māori ($p<0.05$) and female ($p<0.05$). 56.8% of all patients experienced a total diagnostic interval (TDI) >120 days. Long TDIs were associated with changes in bowel habit (COBH) ($p<0.05$) and multiple GP consultations ($p<0.05$). Patients reporting rectal bleeding were less likely to experience a long TDI (OR 0.27, 95% CI: 0.12-0.61) and appraisal/help-seeking interval (OR, 0.18, 95% CI: 0.06-0.57). Young patients were more likely to report longer appraisal/help-seeking intervals (OR, 3.45, 95% CI: 1.25-9.55) and females a longer GP diagnostic interval (OR, 2.19, 95% CI: 1.08-4.44).

Conclusion: NZ patients with CRC experience long diagnostic intervals, attributed to patient and health system factors. Young patients, Māori, females and patients experiencing COBH may be at particular risk. With CRCs diagnostic difficulty, we need to increase symptom awareness for patients and GPs. Concentrated efforts are needed to ensure equity for Māori in access to screening, diagnostics and treatment.

Keywords: Colorectal cancer, general practice, delayed diagnosis, bowel, New Zealand, questionnaire

Lay summary

New Zealand has high rates of colorectal cancer but low rates of early detection. We interviewed newly diagnosed patients about their diagnostic experience to identify factors influencing time to diagnosis. More than half of patients experienced a long diagnostic interval. Young patients, Māori, females and patients experiencing changes of bowel habit may be at particular risk for long intervals. With the diagnostic difficulty of CRC, we need to increase CRC symptom awareness for patients and GPs.

Background

Colorectal cancer (CRC) is the second most common cancer in New Zealand (NZ)[1], with over 3,000 newly registered cases and approximately 1,200 deaths in 2018[2]. NZ has a low rate of early stage CRC diagnosis[3], attributed, in part, to the absence of a nationwide screening programme which is still being instituted regionally. Therefore, the majority of NZ CRC cases are diagnosed through symptomatic presentation to general practice. However, delays to CRC diagnosis are common in general practice, with lengthy diagnostic intervals constituting 27% of complaints to the Health and Disability Commissioner (HDC) (2004 to 2013)[4]. Factors associated with long times to diagnosis are multifactorial[5], and involve symptom characteristics, patient and health system factors. These factors can be considered according to the Model of Pathways to Treatment (MPT)[6], which outlines four phases of potential delay from first symptom recognition to start of treatment (the appraisal, help seeking, diagnostic, and pre-treatment intervals) and allows for non-linear movement through the phases, with patients potentially revisiting phases after consulting health care professionals.

Importantly, CRC is more difficult to diagnose in terms of its presenting symptoms than other cancers[7,8]. The appraisal interval, where patients recognise that symptoms need medical investigation, has high potential for delay[5]. Common symptoms include rectal bleeding, abdominal pain, and a change of bowel habit (COBH) (either sudden onset diarrhoea or constipation)[9], but these symptoms also occur widely in the general population[10], and are often a result of more benign conditions such as haemorrhoids, or irritable bowel syndrome (IBS). Difficulty in recognising the potential seriousness of symptoms contributes to long appraisal intervals, especially if symptoms are intermittent and have been previously experienced or considered 'normal'. Subsequently, patients often postpone help-seeking, choose to self-manage, or wait for symptom resolution, only consulting a general practitioner (GP) when symptoms have worsened[11], or as with bowel symptoms, might never consult their GP[12]. After symptom appraisal, patients move to the help-seeking phase of the MPT, where they must overcome a number of barriers to consulting their GP, such as fear of tests[5], worry about what investigations might find[9], symptom embarrassment[13], or not wanting to bother the doctor[14]. The quality of the patient-GP relationship[15], and poor continuity of care also impede GP consultations[13]. Young patients might also postpone help-seeking if they perceive that they are too young for symptoms to be cancer-related[5].

GPs also influence diagnostic interval as patient's transition to the diagnostic phase of the MPT. GPs face a difficult task differentiating presenting symptoms that may be due to cancer from benign conditions, and must interpret symptoms while considering patient medical history and comorbid conditions. Comorbidity especially complicates accurate diagnosis[16], particularly if conditions are gastrointestinal (GI) in nature (e.g., diverticulitis, IBS). Furthermore, CRC is not common in general practice, with GPs typically diagnosing one patient per year[17]. With CRC diagnoses rare, more common diagnoses are often considered first, especially in the light of existing GI issues or other comorbidity[18], leading to further delay and multiple GP consultations[7]. GP communication is vital, and can be associated with long intervals, especially if GPs reassure patients not to worry[19], advise to wait and self-monitor symptoms[6], or do not take symptoms

seriously[20]. Furthermore, even if a GP recognises further investigation *is* warranted, NZ GPs have less access to specialist tests (e.g., colonoscopy)[21].

With low rates of early stage CRC diagnosis in NZ[3], we aimed to investigate factors associated with lengthy diagnostic intervals in a cohort of patients newly diagnosed with CRC from the Midland region.

Methods

Patient recruitment

Patients were recruited from the Midland region, including Waikato (population: 400,000+), Tairawhiti (population: 40,000+) and Lakes (population: 100,000+) District Health Boards (DHBs). Patients were initially recruited through referral from a cancer nurse specialist (CNS) at each DHB and then contacted via telephone for interview to complete a structured questionnaire. Additional recruitment occurred via mail out of study information using DHB clinic lists, a poster placed at Waikato hospital and private consulting rooms, and Bowel Cancer NZs social media page. No interviews to collect questionnaire data occurred without patient consent. Patients were eligible for recruitment if they had been diagnosed within 12 months (study period from 2016-2019) and had not been diagnosed through regional screening. Interviews were held from April 2018 to March 2020 and were usually carried out via telephone (or CNS at Lakes DHB). Interviews were occasionally conducted at Waikato DHB or at the patient's home by prior arrangement. Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156).

Data Collection

Data were collected via interview to deliver a structured questionnaire based on the MPT[6] and a modified SYMPTOM questionnaire[18]. Questionnaires were delivered via iPad using web-based survey tool CrowdSignal. During the interview, patients were invited to speak about their diagnostic experience, focussing on symptoms and the timeline from symptom onset to when a health care professional (usually a GP) was consulted to confirmed diagnosis. Additional questions captured the patient experience with their primary health care provider. Patient-reported comorbidities were recorded: i.e., asthma, chronic obstructive pulmonary disease, other lung issues, heart disease, anxiety or depression, inflammatory bowel disease, IBS, peptic ulcer, previous cancer, diabetes and arthritis. Comorbidities were combined and recorded as 0 or 1+ for analysis. Diagnostic pathway included: GP, hospital emergency department (ED), incidental (as a result of a GP or hospital testing/procedure(s) for other conditions) and other (self-referral to specialists, being monitored for CRC or other conditions).

Dates of first symptom presentation and first GP presentation were patient-reported. Exact patient-reported dates were used, but if inexact dates were given an estimated date was used (e.g., 'May 2018' was recorded as the midpoint of that month (e.g., 15th May 2018)). For Waikato

patients, clinical records at Waikato DHB were accessed and date of colonoscopy was recorded as the date of diagnosis.

INSERT FIGURE 1 HERE

Delay intervals

The MPT[6] was used as the framework for data analysis, focussing on the first three MPT intervals: appraisal, help seeking and diagnostic (see Figure 1). Three intervals were calculated, guided by the Aarhus statement[22] and a previous study[18]. We combined the appraisal/help seeking interval, defined as the period from patient-reported first symptom recognition (first notice of body changes or symptoms) to date of first GP presentation or ED admission (when a clinician starts investigations or referral). The GP diagnostic interval was calculated as the date of first GP consult/ED admission to date of diagnosis (defined as date of first confirmation of cancer) and the total diagnostic interval (TDI) was taken as the date of first symptom onset to date of diagnosis. Delay in each interval was defined as >120 days and no delay was classified as <120 days, based on Australian clinical guidelines[23]. This period covers from first presentation to healthcare to diagnosis as a maximum of 120 days, but does not account for the patient interval.

Data analysis

Descriptive statistics were used to describe the characteristics of the study population. Chi-square analysis and logistic regression were used to analyse factors influencing diagnostic intervals. Tests for significance were two-tailed with $p < 0.05$ considered statistically significant. Analyses were performed using SPSS version 25 (New York, US).

Results

Two-hundred and thirty-five patients were recruited from Waikato (n=142), Tairawhiti (n=15) and Lakes (n=60) DHBs, and 18 patients were recruited through NZ Bowel Cancer. Exclusion criteria included diagnoses through regional bowel screening (n=7), patients more than 12 months post diagnosis (n=32), and non-CRC diagnoses (n=1). Following these exclusions, 195 patients remained.

Table 1 shows the characteristics of the study population. The majority (74.9%) of patients were aged >60, non-Māori (84.6%) and male (55.9%). A single, first patient-reported symptom ths prior to diagnosis was experienced by 145 (74.4%) patients, and multiple (i.e., 2-5) first-noticed symptoms were reported by 39 (20.0%) patients. COBH was the most common symptom across

the whole cohort, reported by 123 (63.1%) patients, followed by rectal bleeding, reported by 108 (55.4%) patients. However, the most common first-noticed, patient-reported symptom was rectal bleeding (31.8%) followed by COBH (26.7%). When asked if they had reported their symptom(s) to a GP or nurse, 36 (19.6%) patients did not report their COBH, and 17 (9.2%) did not report rectal bleeding. Eleven patients (5.6%) reported zero symptoms and were diagnosed through investigations for other conditions (e.g., monitoring due to a family history). The most common diagnostic pathway was through general practice (64.1%), followed by ED admission (15.4%). Sixty-two percent of patients reported multiple comorbidities, with 10 (5.1%) patients reporting GI conditions (inflammatory bowel disease or IBS) as existing.

INSERT TABLE 1 HERE

Appraisal/help-seeking interval

Table 2 shows the population characteristics stratified by appraisal/help-seeking, GP diagnostic and TDI. Due to small numbers, weight loss, fatigue and loss of appetite were combined in an 'other' category. Data from the 11 patients with zero symptoms were excluded from all further analyses, giving a sample size of 184. Only 35 (19.0%) patients appraised symptoms and engaged in help-seeking > 120 days. Of these, 20 (57.1%) were experiencing rectal bleeding. Patients who delayed seeking medical help were more likely to be <60 (p=0.445), male (p=0.537), and reporting a COBH (p=0.072). Route to diagnosis in this phase was a significant factor (p-value<0.05).

GP Diagnostic interval

For the GP diagnostic interval, 66 (35.9%) patients experienced an interval of >120 days. Patients who experienced longer intervals during this phase were significantly more likely to be Māori (p=0.010) and female (p=0.039). ED admission, or being diagnosed through an incidental or 'other' finding was the faster route to diagnosis (p=0.000).

Total diagnostic interval

A TDI with known dates was calculated for 183 patients. Over half (56.8%) of patients experienced a TDI >120 days. Factors significantly associated with a TDI >120 days were COBH (p=0.043) and having six or more GP consultations prior to diagnosis (p=0.022). Age<60 (p=0.237), Māori ethnicity (p=0.341) and diagnosis via GP (p=0.717) were non-significant factors.

The median TDI across the whole cohort was 151 days (IQR 61-365), 30 days (IQR 0-93) for the appraisal/help-seeking interval and 66 days (IQR 27-235) for the GP diagnostic interval (see Table 3). Patients <60 had a higher median TDI (240 days) than those aged 60+ (133 days). Māori, and female patients had a longer median TDI and GP diagnostic interval (Māori TDI: 195 days; GP diagnostic: 170 days – females TDI: 181 days; GP diagnostic: 121 days). ED presentation had the shortest median days across all intervals (TDI: 107 days; appraisal/help seeking: 1 day; GP

diagnostic: 47 days), as did rectal bleeding (TDI: 104 days; appraisal/help seeking: 16 days; GP diagnostic: 54 days), with the exception of the appraisal/help seeking phase, where abdominal or anal pain had the shortest median (8 days). Six or more GP consultations had the highest median TDI (174 days).

After adjusting for all factors, patients reporting rectal bleeding were less likely to experience a long TDI (OR 0.27, 95% CI: 0.12-0.61) and appraisal/help-seeking interval (OR, 0.18, 95% CI: 0.06-0.57). Compared to patients aged >60, younger patients were more likely to experience longer appraisal/help-seeking intervals (OR, 3.45, 95% CI: 1.25-9.55) and females were more likely to experience a long GP diagnostic interval (OR, 2.19, 95% CI: 1.08-4.44).

INSERT TABLES 2 AND 3 HERE

Discussion

Intervals to CRC diagnosis were investigated according to three phases of the MPT (appraisal, help seeking, diagnostic). Over half of the cohort experienced a TDI of more than 120 days. As expected from a largely unscreened population, most patients were diagnosed through general practice. Rectal bleeding and COBH were the most common first-noticed, patient-reported symptoms. Rectal bleeding was associated with a shorter appraisal/help-seeking, GP diagnostic and TDI. Younger patients experienced longer times across all intervals and Māori and female patients were more likely to experience a longer TDI and GP diagnostic interval.

Twenty-five percent of the cohort were aged <60, supporting the growing observation in NZ and internationally that CRC incidence is increasing in younger age groups[24,25]. Younger patients delayed seeking medical help beyond 120 days, perhaps consistent with public perceptions that CRC more commonly affects older people. Compared with rectal bleeding, patients who first-reported a COBH delayed consulting a GP, and almost 20.0% never reported their COBH. This likely reflects difficulty in discriminating bowel changes from more serious conditions, especially if individuals have pre-existing GI issues or consider irregular bowels as 'normal'. Similar to other studies[18,26], we found that rectal bleeding facilitated a medical consultation, especially if bleeding was sudden. Likewise, abdominal pain had the shortest median days to diagnosis, likely reflecting ED admission. Consistent with other research[19], patients reported not appreciating symptom seriousness, being reassured by an alternative GP diagnosis, and not feeling alarmed about symptoms if previously experienced. Given similar findings from another NZ study[26] and CRCs unpopular profile, we need to increase CRC education to improve knowledge and reduce opportunities for delay.

Compared to other cancers, CRC is associated with longer times spent in general practice[27], reflecting the diagnostic difficulty[28]. We report a long GP-related interval for 35.9% of patients from first GP consult to diagnosis and a TDI for 56.5%, with a median 151 days from symptom onset to diagnosis. Patients were more likely to experience a longer GP diagnostic and TDI if they were Māori, female or reported a COBH as their first-noticed symptom. Māori have a lower incidence of CRC than NZ Europeans[29], but experience greater inequity accessing health services[30], less choice of GP appointments[31], and less access to chemotherapy[32] and colonoscopy[33]. Our findings for Māori are consistent with other NZ CRC studies[26,34], but, as with those studies, are limited by a small sample size. That said, we support the need for urgent action addressing the inequity of the national bowel screening programme - with the age set at 60 it ignores the higher number of CRC in Māori at a younger age, and contributed to poorer outcomes[35]. While men are more likely to develop CRC than women[36], consistent with studies reporting longer diagnostic intervals for female patients[5,28], females in this cohort had a greater TDI and GP diagnostic interval than males. Proportionally, females were also less likely to be referred for colonoscopy (57.1% compared with 42.9% males). Some female patients described a 'battle', with GPs misattributing symptoms to B12 deficiency or menopause. Gynaecological issues can confound a CRC diagnosis[5], but it is also possible that an unconscious gender bias may be contributing to longer diagnostic intervals for female patients.

COBH was also associated with longer GP-related intervals. With COBH common in the general population and more typically associated with benign conditions, GPs face considerable diagnostic difficulty in discriminating these symptoms from CRC. GPs also face barriers to referring patients for the required diagnostic test, as NZs Ministry of Health (MOH) referral guidelines state that a COBH must be present for >6 weeks and accompanied by rectal bleeding in those aged over 50 for urgent referral[37]. Of the 123 patients who reported a COBH, 78 (63.4%) also had rectal bleeding. Forty-seven (60.3%) of these patients had a TDI >120 days, and 34 (43.6%) had a GP diagnostic interval of >120 days. Some of these patients likely represent missed diagnostic opportunities. Ongoing review of access criteria is needed to ensure inequities are not worsened; the unintended consequences of generic criteria will often worsen access and outcomes in priority populations (i.e., indigenous people). Likewise, 16 (24.2%) people presented to GPs with rectal bleeding but waited >120 days until diagnosis. Some of these patients were misdiagnosed with haemorrhoids - sometimes without a digital rectal exam (DRE). A failure to conduct DREs was a major cause of complaint in the HDC report (2004-2013)[4] and has been frequently cited as a continuing problem in CRC research[8,28]. Calls for increased use of DRE in NZ are not new[38], yet a 2019 NZ study reported no DRE in 42.0% of cases[39], suggesting failure to perform DREs remains an ongoing issue. Another option to reduce missed diagnoses is the Faecal Immunochemical Test (FIT), a widely-used, non-invasive test that can function as a diagnostic step to colonoscopy[40]. NICE guidelines[41] recommend FIT to discriminate those with non-specific abdominal pain and/or COBH, but access to FIT is non-existent in the NZ public health system outside bowel screening. Consequently, GPs cannot use FIT for symptomatic triage of CRC.

Data was collected from a large region in NZ, however, sample size is a limitation. A weakness of questionnaires is that participants may not fully understand or answer questions appropriately. To minimise this risk, data collection was researcher-assisted. However, data were still patient-reported, and while interviews were conducted as close to diagnosis date as possible (within 12 months of diagnosis), patient recall may have been inaccurate. Patient and provider reports of diagnostic time-points can also differ[35]. The questionnaire did not ask for reporting on conditions such as ulcerative colitis, diverticulitis, or Crohn's disease, so we could not provide data on numbers with these conditions. Finally, with a focus on general practice, we did not record the number of patients who may have experienced longer intervals waiting for secondary care appointments (e.g., colonoscopy). In addition, system factors including GP access to diagnostic tests and their impact on TDI were unable to be assessed.

Conclusions

Many NZ patients newly diagnosed with CRC experience long diagnostic intervals, attributed to a combination of patient and health care provider factors. Young patients, Māori, females and patients experiencing a COBH may be at risk for greater chance of delay. With the diagnostic difficulty of CRC, we need to increase the public profile of CRC and symptom awareness for both patients and GPs. There needs to be concentrated efforts to ensure equity for Māori in the national screening programme, as well as in general access to diagnostics and treatment.

Declarations

Ethics approval: Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156). All methods were performed in accordance with the relevant guidelines and regulations. All participants provided written and verbal informed consent prior to participation in the study.

Funding: This work was supported by the Health Research Council of New Zealand (HRC grant number 17/147).

Conflict of interest: The authors declare no conflict of interest.

Data availability statement: The data underlying this article are available in the article and in its online supplementary material.

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Table 1. Characteristics of patients diagnosed with CRC in the Midland region of NZ (2016-2019) (N=195).

Characteristic	N	%
Age group		
<60	49	25.1
60+	146	74.9
Ethnicity		
non-Māori	165	84.6
Māori	29	14.9
Missing	1	0.5
Gender		
Male	109	55.9
Female	86	44.1
Comorbidities		
0	74	37.9
1+	121	62.1
Number of first-reported symptoms		
0	11	5.6
1	145	74.4
2+	39	20.0
First-reported symptom		
COBH	52	26.7
Rectal bleeding	62	31.8
Abdominal/anal pain	32	16.4
Weight loss	5	2.6
Loss of appetite	1	0.5
Fatigue	12	6.2
Other*	20	10.3
No reported symptoms	11	5.6
Diagnostic pathway		
GP	125	64.1
Incidental	29	14.9
ED	30	15.4
Other	11	5.6
Did your GP refer for colonoscopy?		
No	72	36.9
Yes	108	55.4
NA/Missing/Don't know	15	7.7
Number of GP visits		
0-5	128	65.6
6+	66	33.8
Don't know	1	0.5

*Other symptoms include bloating, vomiting, nausea, iron deficiency, anaemia, dizziness, loss of appetite

Table 2. The characteristics of all symptomatic patients diagnosed with CRC in the Midland region of NZ (2016-2019), stratified by appraisal/help-seeking, GP diagnostic and total diagnostic interval (TDI) (n=184).

	Appraisal/Help-seeking Interval						GP Diagnostic Interval						Total Diagnostic Interval						Totals
Characteristic	**<120 days n=130**	**%**	**>120 days n=35**	**%**	**Unknown n=19**	**p**	**<120 days n=99**	**%**	**>120 days n=66**	**%**	**Unknown n=19**	**p**	**<120 days n=79**	**%**	**>120 days n=104**	**%**	**Unknown n=1**	**p**	**n=184**
Age group																			
<60	32	72.7	12	27.3	4	0.445	26	59.1	18	40.9	4	0.911	17	35.4	31	64.6	0	0.237	48
60+	98	81.0	23	19.0	15		73	60.3	48	39.7	15		62	45.9	73	54.1	1		136
Ethnicity																			
non-Māori	114	79.2	30	20.8	12	**0.016**	90	62.5	54	37.5	12	**0.010**	70	45.2	85	54.8	1	0.341	156
Māori	16	80.0	4	20.0	7		9	45.0	11	55.0	7		9	33.3	18	66.7	0		27
Missing	0	0.0	1	100.0	0		0	0.0	1	100.0	0		0	0.0	1	100.0	0		1
Gender																			
Male	68	76.4	21	23.6	12	0.537	61	68.5	28	31.5	12	**0.039**	48	48.0	52	52.0	1	0.178	101
Female	62	81.6	14	18.4	7		38	50.0	38	50.0	7		31	37.3	52	62.7	0		83
Comorbidities																			
0	51	79.7	13	20.3	6	0.784	40	62.5	24	37.5	6	0.723	30	42.9	40	57.1	0	0.535	70
1+	79	78.2	22	21.8	13		59	58.4	42	41.58	13		49	43.4	64	56.6	1		114
First reported symptom																			
COBH	33	68.8	15	31.3	4	0.072	27	56.3	21	43.8	4	0.157	16	30.8	36	69.2	0	**0.043**	52
Bleeding	50	89.3	6	10.7	6		40	71.4	16	28.6	6		35	56.5	27	43.5	0		62
Abdominal/anal pain	24	80.0	6	20.0	2		17	56.7	13	43.3	2		14	43.8	18	56.3	0		32
Other	23	74.2	8	25.8	7		15	48.4	16	51.6	7		14	37.8	23	62.2	1		38
Diagnostic pathway																			
GP	94	78.3	26	21.7	5	**0.000**	72	60.0	48	40.0	5	**0.000**	53	42.4	72	57.6	0	0.717	125
Incidental	10	83.3	2	16.7	11		6	50.0	6	50.0	11		8	36.4	14	63.6	1		23
ED	21	75.0	7	25.0	1		19	67.9	9	32.1	1		15	51.7	14	48.3	0		29
Other	5	100.0	0	0.0	2		2	40.0	3	60.0	2		3	42.9	4	57.1	0		7
Number of GP visits																			
0-5	85	77.3	25	22.7	11	0.788	68	61.8	42	38.2	11	0.062	52	43.3	68	56.7	1	**0.022**	121
6+	44	81.5	10	18.5	8		30	55.6	24	44.4	8		26	41.9	36	58.1	0		62
Don't know	1	100.0	0	0.0	0		1	100.0	0	0.0	0		1	100.0	0	0.0	0		1

*Other symptoms include weight loss, fatigue, bloating, vomiting, nausea, iron deficiency anaemia, dizziness, loss of appetite.

Table 3. Median number of days patients diagnosed with CRC in the Midland region of NZ (2016-2019) spent in the appraisal/help-seeking, GP diagnostic and total diagnostic intervals (TDI) (n=184).

Characteristic	Appraisal/Help-seeking Interval	GP Diagnostic Interval	Total Diagnostic Interval	Totals
	Median (IQR)	Median (IQR)	Median (IQR)	n
Age group				
<60	30 (0-138)	64 (30-345)	240 (63-562)	48
60+	30 (0-92)	69 (25-191)	133 (61-351)	136
Ethnicity				
non-Māori	30 (0-92)	62 (26-194)	133 (61-351)	156
Māori	22 (0-109)	170 (15-451)	195 (106-662)	27
Missing	–	–	–	1
Gender				
Male	30 (2-108)	53 (15-170)	122 (60-322)	101
Female	30 (0-92)	121 (38-327)	181 (68-613)	83
Comorbidities				
0	30 (1-92)	62 (29-202)	151 (61-343)	70
1+	30 (0-100)	86 (24-256)	143 (61-366)	114
Diagnostic pathway				
GP	31 (14-105)	75 (28-260)	151 (64-365)	125
Incidental	0 (0-26)	101 (35-868)	174 (57-822)	23
ED	1 (0-122)	47 (2-160)	107 (30-365)	29
Other	4 (0-33)	345 (52-945)	143 (81-662)	7
First reported symptom				
COBH	34 (14-174)	91 (31-223)	198 (91-654)	52
Rectal bleeding	16 (0-47)	54 (17-130)	104 (52-326)	62
Abdominal/anal pain	8 (0-94)	93 (7-206)	138 (49-297)	32
Other*	61 (7-127)	165 (21-344)	275 (76-409)	38
Number of GP visits				
0-5	30 (0-109)	64 (28-186)	142 (61-349)	121
6+	30 (0-91)	61 (8-221)	174 (65-444)	62
Don't know	32 (32-32)	32 (32-32)	64 (64-64)	1

*Unknown dates for appraisal/help-seeking and GP diagnostic interval =19, unknown dates for total diagnostic interval=1

*Other symptoms include weight loss, fatigue, bloating, vomiting, nausea, iron deficiency anaemia, dizziness, loss of appetite.

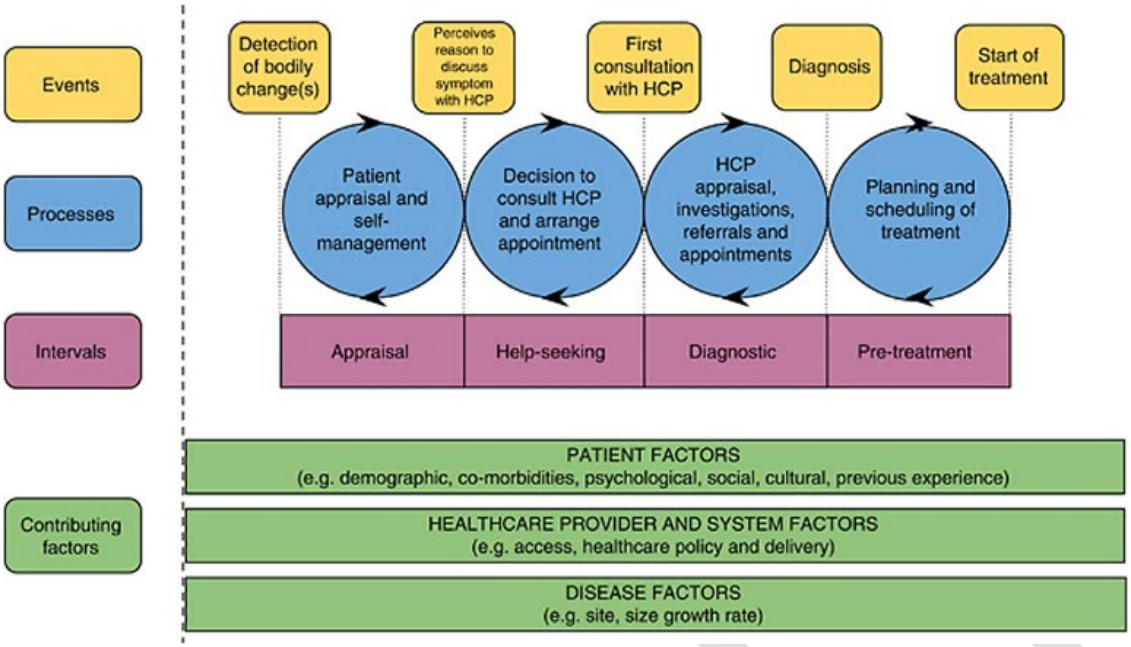

Figure 1. The Model of Pathways to Treatment (MPT)[6].

APPENDIX 7

How do colorectal cancer patients rate their GP: a mixed methods study

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Abstract

Background: New Zealand (NZ) has a high incidence of colorectal cancer (CRC) and low rates of early diagnosis. With screening not yet nationwide, the majority of CRC are diagnosed through general practice. A good patient-general practitioner (GP) relationship can facilitate prompt diagnosis, but when there is a breakdown in this relationship, delays can occur. Delayed diagnosis of CRC in NZ receives a disproportionally high number of complaints directed against GPs, suggesting deficits in the patient-GP connection. We aimed to investigate patient-reported confidence and ratings of their GP during the diagnostic process.

Methods: This study is a mixed methods analysis of responses to a structured questionnaire and free text comments from patients newly diagnosed with CRC in the Midland region of NZ. A total of 195 patients responded to the structured questionnaire, and 113 patients provided additional free text comments. Descriptive statistics were used to describe the study population and chi square analysis determined the statistical significance of factors possibly linked to delay. Free text comments were analysed using a thematic framework.

Results: Most participants rated their GP as 'Very good/Good' at communication with patients about their health conditions and involving them in decisions about their care, and 6.7% of participants rated their overall level of confidence and trust in their GP as 'Not at all'. Age, gender, ethnicity and a longer diagnostic interval were associated with lower confidence and trust. Free text comments were grouped in to three themes: 1. GP Interpersonal skills; (communication, listening, taking patient symptoms seriously), 2. Technical competence; (speed of referral, misdiagnoses, lack of physical examination), and 3. Organisation of general practice care; (appointment length, getting an appointment, continuity of care).

Conclusions: Patients who had experienced delay, Māori, females, and younger patients are more likely to report low confidence and trust in their GP. Poor interpersonal skills, misdiagnoses and not being thoroughly examined are clearly ongoing issues that are associated with longer diagnostic intervals. Short appointment times, access to appointments and poor GP continuity are important components of how patients assess their experience and are particularly important to ensure equal access for Māori patients.

Background

Trust and confidence in general practitioners (GPs) is usually reported as high (1). Factors associated with patient confidence in GPs include clear explanations of tests and treatments, involving patients in decisions about care and patient perceptions that their symptoms are being taken seriously. When trust breaks down and care is perceived to be sub-optimal, conflict can ensue. In New Zealand (NZ) any complaint about health practitioners can be referred to the Health and Disability Commissioner (HDC). A report for the HDC (2004-2013) indicated that approximately 10% of complaints about GPs involved a perceived delay in diagnosis of cancer (2). Colorectal cancer (CRC) - the second most common cancer in NZ (3) - was over-represented, comprising 27% of these complaints. The nature of complaints highlighted in the report were a lack of clinical examinations, patient perceptions of inadequate follow-up of symptoms and poor GP communication.

Delays to CRC diagnosis may contribute to poorer outcomes. Based on international comparisons, NZ has a low rate of early stage CRC (4), with fewer than 12% of patients diagnosed at stage I (5). A contributing factor is not yet having a fully implemented national bowel cancer screening program. CRC is difficult to diagnose (6), with a complex diagnostic process for both patients and GPs. For patients, symptoms can be nonspecific and difficult to recognise as potentially serious in nature and in need of medical investigation (7-9). For GPs, the difficulty lies in the frequency of bowel symptoms in primary care and difficulties in their interpretation. Non-cancer diagnoses are much more common, and can include conditions such as irritable bowel syndrome, inflammatory bowel disease (Crohn's and ulcerative colitis) and diverticular disease. There is accordingly, significant potential for misdiagnosis, especially in the presence of comorbidity (10, 11) or existing gastro-intestinal issues that can confound the presence of CRC symptoms (7, 12, 13).

The patient-GP relationship is an integral aspect of the diagnostic process. A GPs interpersonal skills (e.g., listening, empathy, being non-judgemental) and technical competence (e.g., knowledge, performing physical examinations, proactively investigating, following up on referrals) can either facilitate or impede prompt diagnosis. Good GP communication helps patients feel connected to their GP and the care provided (14), but a lack of empathy, inattentive listening and not taking patients seriously can lead to negative patient-GP interactions (15), patient dissatisfaction (9) and complaints (16). Technical competence is also an important consideration in the patient-GP relationship, but can be outweighed by interpersonal competence (17), highlighting the importance patients place on a GPs' personal style during interactions.

Given the prevalence of CRC complaints in primary care, it is important to investigate patient reported confidence in their GP during the diagnostic process. We therefore interviewed patients recently diagnosed with CRC using a structured questionnaire to investigate factors that lead to high (or low) patient ratings of trust and confidence in their GP and how these factors contribute to the overall diagnostic experience.

Method

Participants

Participants were selected from the Midland region, which includes Waikato (population: 400,000+), Tairawhiti (population: 40,000+) and Lakes (population: 100,000+) District Health Boards (DHBs). Participants were recruited as part of a larger prospective study where data were collected via researcher-assisted interviews that administered a 52-item questionnaire based on the SYMPTOM questionnaire (12). Questionnaire data was then analysed based on the Model of Pathways to Treatment (MPT) (18) framework . Initial recruitment occurred through referral from a CRC cancer nurse specialist (CNS) at each of these DHBs and participants were contacted to arrange a time and day for interview. Additional recruitment within the Waikato region took place via mail out of study information from patient lists obtained from Waikato DHB, use of a poster placed at Waikato hospital and in private consulting rooms, and a Bowel Cancer NZ social media page. No interviews took place until a signed consent form or written consent via email or text message was obtained.

Participants were selected for recruitment if they had been diagnosed and interviewed within 12 months of diagnosis (study period from 2016-2019) and had not participated in bowel screening (where screening has been implemented regionally (e.g., Lakes DHB)). Interviews took place from April 2018 to March 2020. During the interview, participants were invited to speak about their experience of being diagnosed with CRC, with a particular focus on patient-reported symptoms and the timeline from symptom onset to when a health care professional (usually a GP) was consulted. The results of this larger study are not reported here. The current study reports on Section 3 of the questionnaire, which asks about health service utilisation and the patient-GP experience using three key questions (see Tables 2-4).

Responses to these key questions were collected using a 5 –point Likert rating scale ranging from ‘Very good’ to ‘Very poor’ or ‘Yes definitely’ to ‘Not at all’. All three questions also included ‘Doesn’t apply’ and ‘Don’t know’ as possible response options. In addition, free text comments were recorded verbatim by the researcher at any point during the interview, but were specifically prompted in Section 3 due to these questions’ particular relation to the patient-GP experience. Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156).

Delay intervals

The MPT(18) provided the theoretical framework for data analysis and defines four intervals from first symptom/bodily change to commencement of treatment (appraisal, help seeking, diagnostic, and pre-treatment). This study reports only on the total diagnostic interval (TDI), defined as the date of first symptom onset to date of diagnosis as guided by the Aarhus statement (19) and a previous study (12). Diagnostic intervals were defined as >120 days or <120 days, based on Australian clinical guidelines (20).

Data analysis

Descriptive statistics were used to describe the study population and the characteristics of the patients who provided free text comments. Chi square analysis was used to determine any statistical significance. All tests for significance were two-tailed with $p < 0.05$ considered a statistically significant result. All data analyses were performed using SPSS version 25 (New York, US). Additional free text comments were compiled, and these responses were analysed by the primary author (TB). As described in a similar study (21), free-text comments in the current study were also considered as unstructured and unguided qualitative data, where thematic analysis techniques (22) were applied. Comments were coded manually using highlighters in an Excel spreadsheet and then analysed for themes and grouped into categories.

Results

Table 1 shows the characteristics of the current cohort. The participants were mostly aged 70-79 (33.8%), non-Māori (84.6%), male (55.9%) and had been diagnosed through their GP (64.1%). Over half (53.3%) of participants had a TDI of more than >120 days. Dates needed to calculate TDI were unknown for 12 participants. Seventy-three (37.4%) participants could not get an appointment with a GP or nurse within 24 hours of calling their medical practice for the purpose of making an appointment (for any reason). The main reason why an appointment could not be made was a lack of available appointments (24.6%). From the current sample, 113 (57.9%) participants offered free text comments relevant to GP-related care (characteristics are shown in the right hand panel of Table 1).

Tables 2-4 show how participants in the current cohort responded to the three key questions relevant to the patient-GP experience. Eighteen participants (9.2 %) rated their GPs communication as 'Neither good nor bad/Poor or Very poor'. The majority (79.5%) of participants (n=155) rated their GP involving them in decisions about their care as 'Very good/Good' and 16 (8.2%) participants responded 'Doesn't apply'. When asked for an overall judgment of confidence and trust in their GP, 40 participants (20.5%) rated that level of confidence and trust as 'Yes, to some extent/Not at all'. Chi-square analysis showed that age (p=0.004) and gender (p=0.028) were significantly associated with the confidence and trust rating. Proportionally, more Māori participants gave a 'Yes, to some extent/Not at all' rating of overall confidence and trust in their GP compared to non-Māori (37.9% (11/29) vs. 17.6% (29/165)) but this was not significant (p=0.738).

Free text comments

Three themes were generated from the free text comments provided by patients: GP Interpersonal skills, technical competence and organisation of general practice care.

Theme 1: GP Interpersonal skills

The first theme identified related to a interpersonal skills, which included communication, participants feeling listened to, GPs showing empathy and taking symptoms seriously. Most participants rated their GP as 'Very good' or 'Good' in their communication:

> *….GP is fantastic - he takes the time to explain everything, and is very patient (Male, age 82, stage 1, TDI<120 days)*

However, some participants voiced dissatisfaction with their GPs level of communication, expressing feelings of not being listened to, dismissal, and not having symptoms taken seriously:

> *I had a lot of symptoms, for more than a year that I was always telling him about. I think he thought I was a hypochondriac... Around August 2017 I was very sick, vomiting and tired. I went to the GP, he ruled out the flu and said it must be another infection and left it at that (Female, age 72, stage unknown, TDI>120 days)*

Table 1. Characteristics of the whole study population (N=195) (left) and characteristics of participants who offered additional free text comments (n=113) (right).

Factors	**Whole cohort**		**Free text comments**	
	N=195	**%**	n=113	**%**
Age				
<40	4	2.1	3	2.7
40-49	15	7.7	11	9.7
50-59	30	15.4	20	17.7
60-69	47	24.1	27	23.9
70-79	66	33.8	40	35.4
80+	33	16.9	12	10.6
Ethnicity				
non-Māori	165	84.6	96	85.0
Māori	29	14.9	17	15.0
Unknown	1	0.5	0	0.0
Gender				
Male	109	55.9	58	51.3
Female	86	44.1	55	48.7
Mode of diagnosis				
Through a GP	125	64.1	76	67.3
Incidental finding	29	14.9	19	16.8
Presentation to ED	29	14.9	14	12.4
Other	12	6.2	4	3.5
Total diagnostic interval				
<120 days	79	40.5	43	38.1
>120 days	104	53.3	67	59.3
Unknown	12	6.2	3	2.7
Comorbidities				
0-1	156	80.0	94	83.2
2+	39	20.0	19	16.8
Able to get an appointment within 24hrs?				
Yes	73	37.4	57	50.4
No	120	61.5	55	48.7
Don't know	2	1.0	1	0.9
Why couldn't you get an appointment?				
There were no appointments	48	24.6	34	30.1
GP I did not want to see	12	6.2	11	9.7
No appointments/ GP I did not want to see	8	4.1	6	5.3
Can't always see the same GP/GP unavailable	5	2.6	2	1.8
Another reason	2	1.0	4	3.5

Table 2. Participant responses to the question: Thinking about your last visit to a GP, how good was the doctor at explaining your health conditions and treatments in a way that you could understand?

Factors	Very good/Good		Neither good nor bad/Poor or Very poor		Doesn't Apply	Totals		
	n=175	%	n=18	%	n=2	N=195	%	p
TDI								
<120 days	73	92.4	5	6.3	1	79	40.5	0.919
>120 days	90	86.5	13	12.5	1	104	53.3	
Unknown	12	100.0	0	0.0	0	12	6.2	
Age								
<60	42	85.7	6	12.2	1	49	25.1	0.270
60+	133	91.1	12	8.2	1	146	74.9	
Gender								
Male	97	89.0	10	9.2	2	109	55.9	0.404
Female	78	90.7	8	9.3	0	86	44.1	
Ethnicity								
non-Māori	148	89.7	16	9.7	1	165	84.6	0.883
Māori	26	89.7	2	6.9	1	29	14.9	
Unknown	1	100.0	0	0.0	0	1	0.5	
Comorbidity								
0-1	139	89.1	15	9.6	2	156	80.0	0.071
2+	36	92.3	3	7.7	0	39	20.0	
Number of GP visits								
0-5	114	89.1	12	9.4	2	128	65.6	0.911
6-10	48	90.6	5	9.4	0	53	27.2	
10+	12	92.3	1	7.7	0	13	6.7	
Don't know	1	100.0	0	0.0	0	1	0.5	

Table 3. Participant responses to the question: How good was the doctor at involving you in decisions about your care, e.g. discussing different treatment options?

Factors	Very good/Good		Neither good nor bad/Poor or Very poor		Doesn't Apply	Totals		
	n=155	%	n=24	%	n=16	N=195	%	p
TDI								
<120 days	69	87.3	4	5.1	6	79	40.5	0.168
>120 days	75	72.1	20	19.2	9	104	53.3	
Unknown	11	91.7	0	0.0	1	12	6.2	
Age								
<60	38	77.6	7	14.3	4	49	25.1	0.887
60+	117	80.1	17	11.6	12	146	74.9	
Gender								
Male	88	80.7	10	9.2	11	109	55.9	0.213
Female	67	77.9	14	16.3	5	86	44.1	
Ethnicity								
non-Māori	131	79.4	19	11.5	15	165	84.6	0.759
Māori	23	79.3	5	17.2	1	29	14.9	
Unknown	1	100.0	0	0.0	0	1	0.5	
Comorbidity								
0-1	123	78.8	19	12.2	14	156	80.0	0.356
2+	32	82.1	5	12.8	2	39	20.0	
Number of GP visits								
0-5	102	79.7	15	11.7	11	128	65.6	0.946
6-10	41	77.4	7	13.2	5	53	27.2	
10+	11	84.6	2	15.4	0	13	6.7	
Don't know	1	100.0	0	0.0	0	1	0.5	

Table 4. Participant responses to the question: Do you have confidence and trust in your GP?

Factors	Yes definitely		Yes to some extent/Not at all		Doesn't Apply	Totals		
	n=152	%	n=40	%	n=3	N=195	%	p
TDI								
<120 days	70	88.6	8	10.1	1	79	40.5	0.052
>120 days	71	68.3	31	29.8	2	104	53.3	
Unknown	11	91.7	1	8.3	0	12	6.2	
Age								
<60	30	61.2	18	36.7	1	49	25.1	0.004*
60+	122	83.6	22	15.1	2	146	74.9	
Gender								
Male	90	82.6	16	14.7	3	109	55.9	0.028*
Female	62	72.1	24	27.9	0	86	44.1	
Ethnicity								
non-Māori	134	81.2	29	17.6	2	165	84.6	0.104
Māori	17	58.6	11	37.9	1	29	14.9	
Unknown	1	100.0	0	0.0	0	1	0.5	
Comorbidity								
0-1	120	76.9	33	21.2	3	156	80.0	0.067
2+	32	82.1	7	17.9	0	39	20.0	
Number of GP visits								
0-5	102	79.7	23	18.0	3	128	65.6	0.738
6-10	40	75.5	13	24.5	0	53	27.2	
10+	9	69.2	4	30.8	0	13	6.7	
Don't know	1	100.0	0	0.0	0	1	0.5	

*p=0.05

> *GPs vary a lot – I have had 5 different GPs - all different in their manner. Some thorough, some do not take [me] seriously. It's important that you feel listened to - I felt like I was only being listened to by 2 out of the 5 (Female, age 67, stage unknown, TDI>120 days)*
>
> *I had been to the GP three times in January over the pain and an obvious lump I could feel. I was getting desperate, and took my wife with me. I felt I was not being listened to (Male, age 65, stage 4, TDI>120 days)*

For some, their experience was so distressing that it prompted a change to a different GP or medical practice. This was the case for two participants, who felt particularly dismissed by their

GPs. One described a stressful 8 month 'fight' to get her GP to listen and initiate a specialist referral and the other felt totally disconnected with her care due to her GPs manner:

> *I had a fight with my GP- told him I would make a complaint. Begged him to send me through as urgent……felt he never examined me or listened - I was in and out quickly. I was 2 minutes late for one GP appointment and they refused me….I have since changed GP (Female, age 55, stage 3, TDI>120 days)*

> *GP's don't seem to want to connect with you, feel rushed, didn't want to deal with anything too complicated. Felt they are not concerned with you, felt dismissed…..the GP didn't explain things well enough and was in 'auto-mode'. I can't warm to her and have asked to see someone else (Female, age 58, stage 2, TDI<120 days)*

One participant, who was tattooed and had a prior drug history, felt that this influenced the level of care she was given. Her diagnostic experience also prompted a change of GP post-diagnosis:

> *He was a 'computer GP' who just looked at his computer screen and he had never even checked my blood pressure in all the years I was going to him……I felt I was always being judged by him (Female, age 41, stage 3, TDI>120 days)*

For some participants, feeling dismissed and not taken seriously by their GP might not have prompted a change of GP, but did directly influence their poor rating of overall confidence and trust:

> *[confidence]….not in the first GP, who shrugged off stomach pain as a stomach virus (Female, age 74, stage unknown, TDI>120 days)*

Others felt their young age was the factor that led their GP to not take their symptoms seriously:

> *I have seen my GP countless times and was told back in 2016 that I was 'too young' to have bowel cancer when I asked if symptoms could be the start of something like that (Male, age 41, stage unknown, TDI>120 days)*

However, some participants were more accepting of their GP's interpersonal style, which did not affect their overall perception or level of confidence and trust. One participant gave an honest description of his GP's communication, yet still had total faith in his care:

> *He is terrible at explaining things. I have a long standing relationship with him, and even though he has quirky weird ways, he has proven his level of care to my family multiple times – when the chips are down, you can't beat him (Male, age 76, stage 3, TDI<120 days)*

<u>Theme 2: Technical competence</u>

The technical competence of the GP was also typically appraised by participants during appointments, and provided the second theme identified in free text comments. Technical competence was often judged by the speed in which a referral was made. For some, a 'Not at all' rating of confidence and trust was influenced by a perception that their GP had failed to promptly facilitate a diagnosis:

> *I don't have any confidence in the GP now. She was on the wrong track, had diagnosed 'microscopic colitis'. I had been complaining about worsening symptoms for months (Female, age 52, stage 3, TDI>120 days)*

> *I see different [GPs] all the time and was being monitored for low iron…..it took the Dr a long time to figure out what was wrong….GP does not have good rapport…..took too long to diagnose (Male, age 75, stage 3, TDI>120 days)*

Participants also assessed technical competence by the accuracy in reaching a correct diagnosis. Many participants reported being misdiagnosed and treated for conditions other than cancer:

> *I had consulted a GP and they said if the blood was fresh it was likely to be haemorrhoids (Male, age 63, stage 3, TDI>120 days)*

> *The GP diagnosed an ulcer for the abdominal pain and gave laxatives for the constipation (Female, age 73, stage unknown, TDI>120 days)*

Of concern were the number of participants who reported being misdiagnosed in the absence of a physical examination, which for some, influenced their poor confidence rating:

> *The GP misdiagnosed prostate cancer without doing any prostate cancer checks (Male, age 70, stage 2, TDI>120 days)*

> *He could have done better, as soon as he knew there was blood, he should have done something sooner, despite me stating to him that it could be haemorrhoids - he never did a physical check (Female, age 86, stage 3, TDI>120 days)*

> *I had been going to the GP multiple times to investigate symptoms. When I went to the GP over bleeding, he told me it was haemorrhoids, but didn't explore further. I knew it was not, as I was seeing a lot of blood (Female, age 41, stage 3, TDI>120 days)*

A lack of physical examination was also closely related to the appraisal of a GPs interpersonal skills. This was the case for some, who felt dismissed and not taken seriously when they were not properly examined:

I was pretty much going to the GP every month, and felt like I was getting nowhere….. I told the GP about the blood in my stool, but he asked whether I thought it could be piles - and never had a look himself to check…..I felt nobody was listening, I had a terrible experience….it was only in October when I begged him to send me to the hospital that I was seen (Female, age 55, stage 3, TDI>120 days)

The GP did some blood tests, said everything was clear but declined to view a picture I had taken of blood in the toilet bowl and did not do a physical exam…… felt like they didn't want to deal with a complicated case. I never want to go back (Female, age 71, stage 3, TDI>120 days)

However, there were still participants who, despite experiencing a long diagnostic interval, appraised technical competence positively, especially if their GP was actively engaged in investigating symptoms or if a patient's medical history was acknowledged as contributing to diagnostic difficulty:

One said I was 'too young for cancer' but still referred me, and did bloods (Female, age 31, stage 3, TDI>120 days)

I have a history of endometriosis, so felt their assessments were fair (Female, age 37, stage unknown, TDI>120 days)

Theme 3: Organisation of general practice care

While clearly beyond the scope of a GPs interpersonal and technical competence, many participants commented on health system issues, suggesting that some participants do not view these as distinctly separate from patient-GP consultations. Timing of appointments was a common concern, with short appointment times resulting in participants feeling rushed and not being given enough time for their concerns to be properly heard:

GPs are so limited with time, so they don't explain things fully….I did not feel I was being listened to. My GP only works 2 days a week, I want a GP who is available more often (Male, age 65, stage 4, TDI>120 days)

My GP does not like to waste his time with unnecessary conversation…..he's a difficult bastard…….the good ones do not have time - only 10 minutes per person (Male, age 76, stage 1, TDI>120 days)

I changed GP - was sick of getting 10 minutes for one problem – my GP was just too blasé (Female, age 54, stage 3, TDI>120 days)

Continuity of care was another main concern. While busy practices might offer an appointment with another GP, participants often desired to see the same GP who they felt more comfortable with and who they perceived knew them best:

> *….an issue with getting to see the GP you want at my medical centre - there is a delay in getting to see who you want to see (Male, age 69, stage 1, TDI>120 days)*

> *[My] GP was away on holiday, and I did not want to see another doctor in the interim. I wanted to see someone I knew (Male, age 68, stage 3, TDI>120 days)*

> *I don't always see the same GP, and I would prefer to. The practice is very busy (Female, age 64, stage unknown, TDI<120 days)*

> *I changed practice two years ago, due to a lack of continuity of a regular GP (Male, age 72, stage unknown, TDI<120 days)*

However, other participants were more pragmatic about having consultations with different GPs:

> *They do a good job. Don't mind seeing different doctors as they have different ideas (Male, age 77, stage unknown, TDI>120 days)*

> *Even if I can't get any appointment with my GP, I can see another doctor. My GP is very popular, but I don't mind seeing someone else (Male, age 67, stage unknown, TDI<120 days)*

Finally, some participants expressed a more general sense of dissatisfaction with their medical practice, with many participants commenting on their practice being busy, and feeling frustrated by the lack of access:

> *….the doctor is hard to see as he is not around…it is impossible to see him sometimes (Male, age 61, stage 3, TDI<120 days)*

> *The practice is very busy - not enough doctors, so it is getting harder to get an appointment (Female, age 86, stage 2, TDI<120 days)*

Discussion

We investigated the patient-GP relationship in the context of bowel cancer detection and diagnosis by analysing the open comments and GP ratings from recently diagnosed CRC patients. A diagnosis of cancer is a critical time for a patient, in which expectations of general practice are high. Over half of the current cohort experienced a TDI of more than 120 days. A longer TDI was associated with lower confidence and trust in GPs. Poor interpersonal skills, misdiagnoses and not being thoroughly examined are ongoing issues that contribute to longer diagnostic intervals and impact on the patient-GP relationship.

While it was encouraging to see many participants rating GP communication positively, several participants voiced dissatisfaction with their GPs interpersonal manner, with some participants feeling 'desperate' to get their GP to listen, being made to feel like a hypochondriac, or left 'fighting' to be taken seriously. These feelings, plus an interval of more than 120 days likely contributed to a poor overall rating of confidence and trust for some participants. Patients value having their symptoms taken seriously (1), and want to feel that their GP understands their symptoms from their perspective (23-25). This is especially important for patients disclosing often embarrassing CRC symptoms, and for Māori patients in particular, where revealing symptoms to an (often) non-Māori practitioner may be particularly difficult (26) - especially in the light of current inequities, where Māori have a lower incidence (27) but worse CRC outcomes (28, 29), and less access to chemotherapy (30) and colonoscopy (31). Consistent with other research (21), younger participants in the current study reported a sense of not being taken seriously and females reported low confidence in their GP. Young patients (13, 32) and females (8, 13, 33-35) are more at risk for delayed diagnosis, so GPs should not dismiss the possibility of a CRC diagnosis based on the stereotype of the typical CRC patient (13).

Participants also expressed dissatisfaction with the technical competence of their GP, commenting on the speed in which specialist referrals were made, often perceiving that their GP 'took too long to diagnose'. Misdiagnoses, especially in patients who experienced a longer TDI, were common and are a significant barrier to both patients seeking further GP consultations and GPs reaching a diagnosis (36). However, accurate diagnosis of CRC symptoms is difficult (8, 9). GPs must interpret symptoms in the light of a number of factors, including the presence of comorbid conditions which may disguise CRC symptoms and increase time to diagnose (10, 37). NZ GPs are also disadvantaged by less direct access and slower access to colonoscopy than GPs in other countries (38), largely due to a public hospital system that is based on triage for degree of need, resulting in patients who are not likely to be seen or treated within 6 months being routinely referred back to GPs without being seen. Of concern, however, was the number of misdiagnoses in the absence of a physical examination. Low rates of physical examination prior to diagnosis have been previously reported (6, 8, 35, 39, 40), and were one of the primary sources of complaint against NZ GPs (2), so are clearly an ongoing issue in CRC diagnosis in NZ.

Organisation of general practice care, while not under direct control or responsibility of GPs, was another prominent theme. In particular, participants commented on appointment length, feeling that a '10 min slot' was not long enough to have their issues heard. NZs standard 15 min appointment time is a funding issue, and has been raised as a point of concern by both GPs

and primary care nurses (41). Patients value GPs taking time during appointments (42), and do not like feeling rushed (24, 43). Taking the time within existing consult times to carefully listen is highly appreciated by patients (25) and may help mitigate short appointment times. Clearly this is a balancing act for GPs. Getting an appointment with a desired GP was also highly valued. Irrespective of TDI, participants expressed frustration at not being able to see the same GP, or being offered a different GP for each appointment. Poor relational continuity of care, where a lack of consistency provides patients with unpredictability and no coherence (44), is a source of patient unhappiness (9), increases time to diagnosis (13), and makes patients feel like they are being treated impersonally (43). This is a particular issue for Māori patients, who value continuity of care (45) but do not get offered the same choice of GP appointments (46). We suggest that further investment is needed in primary care, and that primary care organisations focus on improving continuity and patient-GP communication.

Few studies have investigated the patient-GP relationship during the CRC diagnostic pathway from the patient's perspective. We used a mixed methods approach to allow participant voices to be heard. Free text comments provide valuable additional data and are one way to measure a wider range of topics that might not be fully captured with a structured questionnaire (21). However, these are not representative and so cannot be generalised to the views of all participants. Furthermore, patients with a CRC diagnosis are not typical of all cancer patients, so may experience the diagnostic pathway through general practice differently. Data collected was patient-reported, so relied on subjective memory of events and accurate recall of diagnostic dates. While interviews aimed to be conducted as close to diagnosis date as possible (at least within 12 months of diagnosis), patient recall may not have been accurate. Finally, while patient gender could be reported, GP characteristics (including age, gender, time in practice, practice size etc.) were unknown and would be important factors for inclusion in future research.

We report that long diagnostic intervals for CRC are still occurring in primary care, associated with deficits in the patient-GP relationship that have been previously raised by an HDC report (2004-2013) (2). Increased funding into primary care might help address some of these ongoing issues. While the majority of participants in the current study had confidence and trust in their GP, the diagnostic experience was extremely negative for some participants, particularly young patients, Māori, females, and those who experienced a long diagnostic interval. Access to general practice plays a pivotal role and is particularly important to ensure equity for Māori patients.

Abbreviations NZ: New Zealand, CRC: colorectal cancer, GP: general practitioner, MPT: The Model of Pathways to Treatment, DHB: district health board, ED: emergency department, COBH: changes of bowel habit

Declarations

Ethics approval and consent to participate

Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156). All methods were performed in accordance with the relevant guidelines and regulations. All participants provided written and verbal informed consent prior to participation in the study.

Consent for publication

Not required.

Availability of data and materials

The data analysed for the current study are not publically available for ethical reasons. Anonymised data can be made available from the corresponding author on request.

Competing interests

The authors declare no competing interests.

Funding

This work was supported by the Health Research Council of New Zealand (HRC grant number 17/147).

Authors' contributions

TB wrote the main manuscript. JK assisted with the thematic analysis. RL contributed to the study design. LC, RK, TS, DW and JE edited, reviewed and approved of the final manuscript.

Acknowledgements

We would like to acknowledge the participants of the study who gave their time in providing the data.

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https://doi.org/10.1186/s12875-020-01276-w

BMC Family Practice

APPENDIX 8

RESEARCH ARTICLE Open Access

Barriers and facilitators to colorectal cancer diagnosis in New Zealand: a qualitative study

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Abstract

Background: New Zealand (NZ) has high rates of colorectal cancer but low rates of early diagnosis. Due to a lack of understanding of the pre-diagnostic experience from the patient's perspective, it is necessary to investigate potential patient and health system factors that contribute to longer diagnostic intervals. Previous qualitative studies have discussed delays using The Model of Pathways to Treatment, but this has not been explored in the NZ context. This study aimed to understand the patient experience and perception of their general practitioner (GP) through the diagnostic process in the Waikato region of NZ. In particular, we sought to investigate potential barriers and facilitators that contribute to longer diagnostic intervals.

Methods: Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee. Twenty-eight participants, diagnosed with colorectal cancer, were interviewed about their experience. Semi-structured interviews were audio recorded, transcribed verbatim and analysed thematically using The Model of Pathways to Treatment framework (intervals: appraisal, help-seeking, diagnostic).

Results: Participant appraisal of symptoms was a barrier to prompt diagnosis, particularly if symptoms were normalised, intermittent, or isolated in occurrence. Successful self-management techniques also resulted in delayed help-seeking. However if symptoms worsened, disruption to work and daily routines were important facilitators to seeking a GP consultation. Participants positively appraised GPs if they showed good technical competence and were proactive in investigating symptoms. Negative GP appraisals were associated with a lack of physical examinations and misdiagnosis, and left participants feeling dehumanised during the diagnostic process. However high levels of GP interpersonal competence could override poor technical competence, resulting in an overall positive experience, even if the cancer was diagnosed at an advanced stage. Māori participants often appraised symptoms inclusive of their sociocultural environment and considered the impact of their symptoms in relation to family.

Conclusions: The findings of this study highlight the importance of tailored colorectal cancer symptom communication in health campaigns, and indicate the significance of the interpersonal competence aspect of GP-patient interactions. These findings suggest that interpersonal competence be overtly displayed in all GP interactions to ensure a higher likelihood of a positive experience for the patient.

Keywords: Colorectal cancer, Delays, Patient-physician relationship

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Background

New Zealand (NZ) has one of the highest rates of colorectal cancer (CRC) in the world. CRC is NZs second most common cause of cancer mortality with over 1200 deaths per annum from around 3000 registered cases [1]. Māori, the indigenous population, are 30% less likely to be diagnosed with CRC but their mortality rates are only slightly lower than NZ European [2]. NZ has a low rate of early stage CRC diagnosis by international standards [3]. Those diagnosed with early stage (I and II) CRC have a better prognosis - at 90% 5-year survival -than those diagnosed with late stage disease (III or IV), at 14% 5-year survival [4]. However, the proportion of Māori and Pacific peoples who have metastatic CRC at diagnosis is much higher than for NZ European (Māori: 31.6%, Pacific: 34.9%, non-Māori/non-Pacific: 22.8%) [5]. These inequities have a considerable and disproportionate impact on poorer outcomes.

Aside from bowel screening, which began gradual regional implementation from 2017 but at the point of this writing has not yet been fully implemented nationwide, improving timely diagnosis is the most important step in ensuring that CRC patients have a better chance at survival [6]. Previous research (the PIPER project) [5] has extensively examined the management of CRC in NZ post-diagnosis and highlighted the need for increased understanding of patient and health system delays prior to diagnosis. Indeed, a NZ Health and Disability Commissioner report (2004–2013) [7], has documented an over-representation of CRC among cancers with longer diagnostic intervals, with the longest times to diagnosis occurring in primary care [7]. Contributing factors to general practitioner (GP) related delay were a lack of clinical examinations and the non-specific presentation of CRC symptoms. Recent research with Māori communities has indicated continuity of care with a trusted GP is needed for general practice to engage better with Māori patients [8].

International studies have indicated that patient, physician and health system delays are key factors associated with late stage diagnosis of CRC. A qualitative study of 20 men in Australia, for example, found delays were associated with patient misinterpretation of symptoms, a failure to attribute symptoms to cancer, and subsequent delays in consulting a health care professional [9]. Other studies have also linked longer diagnostic intervals to CRC symptoms, which are commonly associated with more benign conditions such as irritable bowel syndrome or haemorrhoids, patient-GP communication about symptoms, public and GP awareness of CRC, and hospital system delays in referral and scheduling of colonoscopies [9–11].

Due to the high mortality rates of CRC in NZ and a lack of understanding of the pre-diagnostic experience from the patient's perspective, it is necessary to investigate the potential barriers and facilitators of CRC diagnosis. Previous qualitative studies have discussed patient and system related delays to diagnosis using The Model of Pathways to Treatment (MPT) [9, 10, 12, 13] but this has not been explored in the NZ context. We report here the qualitative component of a larger study investigating delay and increasing access to early diagnosis for CRC (HRC 17/147). The aim of the current study was to understand the NZ patient experience during the CRC detection period, with a focus on barriers and facilitators to diagnosis.

Method

Participants

The 28 participants in this study were previously surveyed as part of a broader quantitative study and had indicated their willingness to take part in an interview. All participants had been diagnosed with CRC within the previous year (study period from 2016 to 2019). They were recruited either through mail out or referral from a CRC cancer nurse specialist at one of the regional district health boards (DHBs) involved in the study (e.g., Waikato, Lakes and Tairawhiti DHBs).

Participants were purposively sampled to obtain representation across key groups (e.g., ethnicity, gender and those who had, and had not, experienced a long interval to diagnosis, as determined by the earlier quantitative study). Three delay intervals were calculated, guided by the Aarhus statement - a guideline for reporting time intervals in cancer-diagnosis research [14], and a previous study [15]. The appraisal/help-seeking interval was determined from patient-reported first symptom recognition (when body changes or symptoms are first noticed) to the date of first presentation to GP or emergency department (ED) admission (when a clinician can start investigations or referral), the diagnostic interval was calculated from the date of first GP consult or ED admission to date of diagnosis (defined as date of first confirmation of cancer) and the total interval was taken as the date of first symptom onset to date of diagnosis. Delay in each of these intervals was defined as >3 months and no delay was classified as <3 months, based on a previous review [16]. Participants who were diagnosed through an incidental finding ($n = 3$) or other (usually monitoring ($n = 1$) were not included in delay interval calculations. Participants resided in the midland region of NZ. Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156).

Data collection

Potential participants were initially contacted via telephone and invited to take part in the qualitative phase of

the study. A convenient time and day were arranged to meet for interview. Interviews were usually carried out at the participant's home and were held from May–December 2019. Written and verbal consent had already been obtained from the earlier quantitative study, but additional verbal consent was also obtained and recorded via audio device immediately prior to commencement of the interview.

Interviews were semi-structured. Before the interview commenced, the objective of the study was restated and study information was read, with an emphasis on the participants' rights and confidentiality. Māori participants had the option of opening the interview with prayer (karakia), and a culturally driven process of building rapport between the interviewer and participants was followed (whanaungatanga). Participants were thanked for agreeing to participate and compensated with a $30 travel voucher for their time. All interviews were conducted by the same female interviewer (KN) and directed by an interview guide (see supplementary material).

During the interview, participants were invited to speak about their experience of being diagnosed with CRC. A particular focus of the interview was to hear their experiences of symptoms, the timeline from first symptom recognition to diagnosis, their experiences with their GP and their awareness of CRC symptoms prior to diagnosis. All participants were invited to speak about any other information significant to their experience. No time limits were placed on interview duration. Interview data were recorded via audio device, and recordings were transcribed verbatim by the interviewer. All participants were offered the opportunity to review or amend their interview transcripts, however, no participants undertook a review.

Analytical framework

The MPT [17] was used as a theoretical framework for the development of the interview schedule and data analysis. The MPT defines four intervals from first symptom/bodily change to commencement of treatment (appraisal, help seeking, diagnostic, and pre-treatment) (see Fig. 1). These intervals are influenced by factors relating to the patient, healthcare provider and system, and disease. This study focused on the first three intervals of the MPT: appraisal, help seeking, and diagnostic. The fourth interval, pre-treatment, was not the primary focus of this study and has been covered elsewhere [5]. Initial coding by the interviewer identified barriers and facilitators to diagnosis. Codes were then grouped into themes based on the MPT model. The Māori data were analysed collaboratively between the interviewer (KN), a qualitative research colleague (SC) and a Māori researcher (JK). Findings are reported according to COREQ guidelines for qualitative research (see supplementary material).

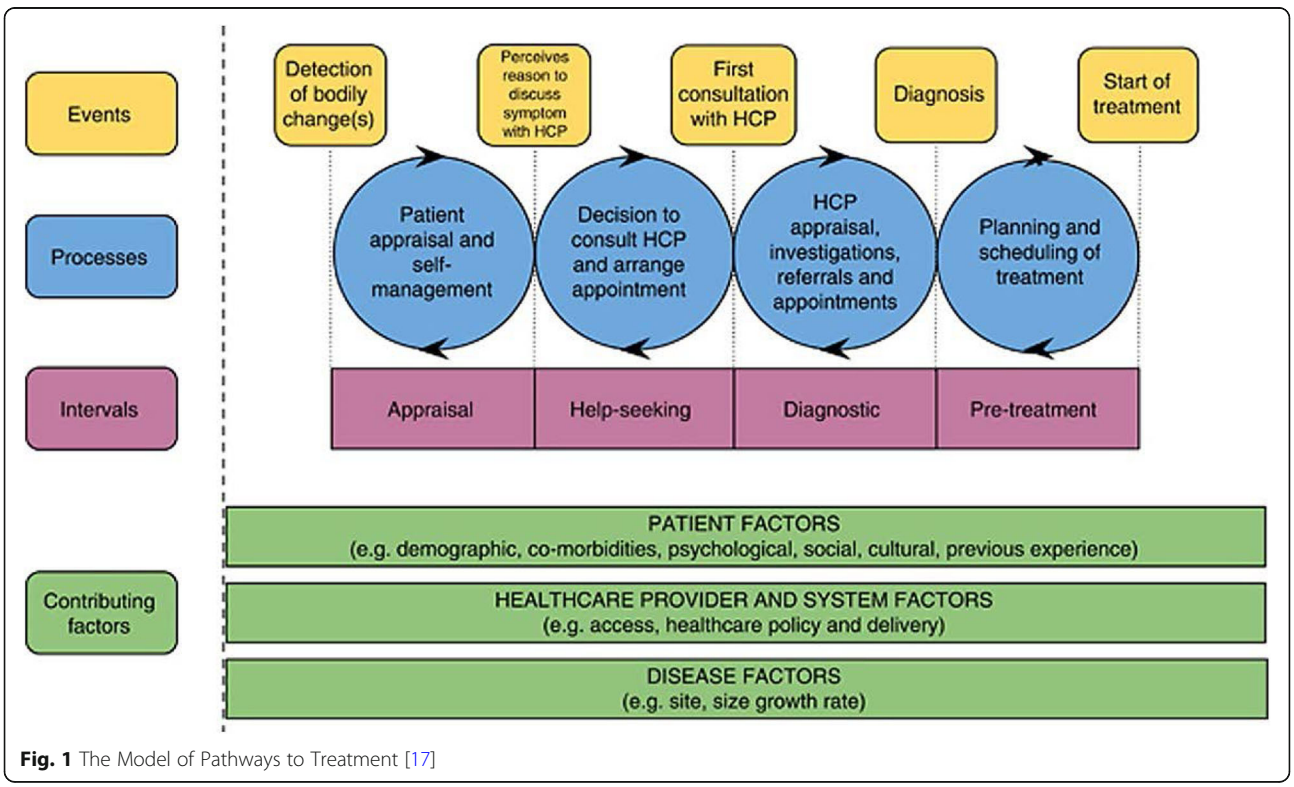

Fig. 1 The Model of Pathways to Treatment [17]

Findings

Findings are presented as an overall summary of the participants who experienced delay and those who experienced no delay, followed by rich data within each of the MPT phases and their subthemes. In the appraisal interval the subthemes were self-appraisal and self-management, symptoms worsen was a subtheme in the help-seeking interval, the diagnostic interval subthemes were other diagnoses and patient appraisal of GP. Table 1 shows the characteristics of all participants interviewed. At the time of the interviews, the age of participants ranged from 42 to 86. Cancer stage was obtained from clinical records. Nineteen participants were non-Māori and nine were Māori. The most common patient-reported first symptom was bleeding, followed by changes of bowel habit (COBH). Most participants had been diagnosed through investigations arranged by their GP. Almost 60% of all participants experienced a longer total interval, and over half of all Māori patients experienced a longer total interval. Interviews were not extended beyond 28 participants as data saturation had been reached.

Table 1 Participant characteristics ($n = 28$)

Characteristic		n	%
Gender	Male	15	53.6
	Female	13	46.4
Age	< 40	0	0.0
	40–49	4	14.3
	50–59	2	7.1
	60–69	11	39.3
	70–79	7	25.0
	80+	3	10.7
	Unknown	1	3.6
Ethnicity	Non- Māori	19	67.9
	Māori	9	32.1
First symptom	COBH	5	17.9
	Bleeding	9	32.1
	Pain	4	14.3
	Weight loss	2	7.1
	Anaemia	2	7.1
	Other	3	10.7
	None	3	10.7
Mode of detection	Through my GP	17	60.7
	Incidental finding	3	10.7
	Presented to ED	5	17.9
	Other	1	3.6
	Unknown	2	7.1
Stage	I	5	17.9
	II	10	35.7
	III	9	32.1
	IV	2	7.1
	Unknown	2	7.1
Total interval	No delay	10	35.7
	Delay	16	57.1
	Unknown	2	7.1
Appraisal/Help-seeking interval	No delay	16	57.1
	Delay	7	25.0
	Unknown	5	17.9
Diagnostic interval	No delay	13	46.4
	Delay	12	42.9
	Unknown	3	10.7

Appraisal interval

Self-appraisal The first theme identified was self-appraisal. All symptomatic participants engaged in a period of symptom self-appraisal, which determined whether or not they consulted a GP. Self-appraisal typically began upon first symptom recognition, whereby the severity of that symptom was appraised and perceived either as 'normal' (i.e., similar to a previously experienced symptom) or abnormal (i.e., not previously experienced). If symptoms were normalised, participants typically felt unalarmed, and a GP was less likely to be consulted. One participant normalised their tiredness due to a vegetarian diet, and decided that a GP was not warranted:

> *But I've been vegetarian for about 15 years, and I've always had a naturally low blood iron level. (Male, stage 3)*

Others attributed COBH to previous experiences of stomach ulcers or psychological conditions:

> *I have always had a funny guts for, you know years, and years and years … before that I'd actually had a stomach ulcer. So I thought, oh probably something like that. (Male, stage 2).*

> *I brushed my diarrhoea off to a large extent, because I knew how my stomach reacts to, tension and stress. (Female, stage 4)*

A GP was also not consulted if a symptom was perceived as an isolated case (e.g., just one bout of bleeding) or if participants attributed symptoms to a benign health issue. For example, if symptoms could be explained by factors such as recent dietary change, changes in exercise routine, stress, lack of fitness, diverticulitis, haemorrhoids, stomach ulcers or emotional tension, a GP was

often not consulted immediately. One participant attributed food intake as being responsible for the blood in her stool:

> *Often, I used to, when I wipe my behind, I often used to look at it and think, mmm- is there a sign of red in that? But then it was persimmons season, and it was summer we'd been eating a lot of salads. Is it the beetroot, is it the tomatoes, is it the persimmons? I always found another excuse. (Female, stage 4)*

In contrast, when participants perceived their symptoms as abnormal (e.g., excessive bleeding from the bowel), a GP was more likely to be consulted. One participant assessed bleeding as a stark contrast to their usual bowel habits, which facilitated immediate help-seeking:

> *It was just blood, everywhere, and the water just turned bright red … So I went up to the hospital. The emergency department. (Male, stage 4)*

Many of the Māori participants included the impact of their symptoms on their sociocultural environment in their self-appraisal. In particular, symptoms were perceived as less concerning if they could stay private, but once the symptoms became obvious to others around them, they decided to seek advice.

> *I kind of put my head down on my desk and my work colleague he walked past and he says, hey you! You better get to the doctors. You look terrible he says. You look like crap! I said thanks for that! (Female, stage 3)*

> *Sometimes when I was at work, I couldn't make it [to the toilet] and um, you sort of um, dirty underwear sort of thing. So changed my underwear every, twice a day, as it got really embarrassing you know? You are too frightened to sit down and have a smoko with the rest of the mates. And you know, they whether they could smell you, I don't know, but- (Male, stage 3)*

For all the participants, symptoms such as abdominal pain, unexplained weight loss and nausea were perceived as abnormal, and so facilitated a faster GP consultation than other symptoms.

Self-management Self-management was a second theme identified in the appraisal interval. Once symptoms had been appraised, participants employed various self-management techniques. Self-management was usually informed by the type of symptom experienced, the participant's perception of their own level of health literacy and their previous experience of self-managing symptoms. Self-management ranged from over the counter medication (e.g., for symptoms such as diarrhoea, constipation, and nausea), to dietary or exercise routine changes, to simply waiting for psychological stress to abate:

> *I have some diarrhoea tablets to stop the diarrhoea. (Male, stage 2)*

> *It was bad diarrhoea. But, um, with the excitement of booking all our holiday and everything I just thought 'oh its excitement, it will disappear once all that's done'. (Female, stage 4).*

Self-management and self-appraisal were closely related behaviours. While self-managing, self-appraisal was commonly revisited as participants monitored the progress of the self-management strategies they were employing. Self-management, if successful, resulted in delayed help-seeking if participants felt symptoms had subsided to a more manageable level and therefore did not require professional medical help.

Help- seeking interval

Symptoms worsen During the help-seeking interval, the worsening of symptoms was an example of how severe symptoms had to get before a GP was consulted, so was an important facilitator to help-seeking. Self-management was often a temporary strategy, as participants not only reported the return of symptoms, but also usually experienced a pronounced increase in severity whereby symptoms became hard to manage (e.g., if medications were no longer being effective, or dietary changes no longer relieved bowel habits or pain):

> *My symptoms weren't improving in fact I think … just made it worse, you know, so I noticed a lot more. (Male, stage 3)*

For some participants, it was an increase in the number of additional symptoms that warranted cause for concern and facilitated a GP consultation. One participant reported beginning with manageable symptoms that did not cause alarm, such as loss of appetite, however, as time progressed, additional symptoms presented and became unmanageable, prompting a GP consultation:

> *In November, a year previously, I, um started having, weight loss and loss of appetite. [Then a while later] either constipation or diarrhoea [so I] went to my local doctor. (Female, stage 4)*

For another participant, the smell associated with bloody stools prompted him to see his GP:

> *The smell is the one that probably sticks out the most because it, it just, just lingers aye. It just sits on your tongue like 'ugggh'. (Male, stage 4)*

Some participants also recognised that symptoms had become unmanageable in their daily routine, as indicated by a change in their physical ability to perform usual household tasks, jobs or manage holidays. One participant reported a lack of energy for any non-work areas of life and another participant outlined the disruption a lack of control over bowel movements caused to a working holiday:

> *My life consisted of going to work and coming home and getting my nightie on and going straight to bed. Every night. (Female, stage 4)*

> *While I was over there, the pressures like going to the toilet, um was, chronic, and sometimes I'd go, and, and I'd go back to class and then, you know, 15 minutes later I think 'Oh god I gotta go again!' (Male, stage 3)*

One participant reported that he was managing his symptoms initially, however once symptoms worsened, he was unable to complete his work efficiently and had to be close to a toilet throughout the day:

> *I was going to the toilet around about 10 times a day then, and then um, it got worse. I was going 30 / 40 times a day … It was a nuisance. Like, I'd be up on the bloody roof [working, and think] Oh sh**! Down the ladder, into the portaloo – you know? (Male, stage 2)*

In this interval the Māori participants were more likely to consider the impact of their symptoms in relation to their families. This included overcoming their concerns about needing to accept help:

> *You know in the mirror and you're like that's me, because I want to feel positive aye and I want to have pride aye. You know. I have a two year old daughter that um, man I want her to look up to me like, yeah 'churr my dad' she would like that. (Male, stage 3)*

> *I don't want to wait until later and write down, and go through all those emotions. Um, when I am meant to be strong for my children … I want to be there for that. (Male, stage 4)*

Disruption to work and inability to manage a daily routine were important facilitators to seeking help for both Māori and non-Māori participants, and was an indicator that self-management options were exhausted/no longer effective and that their health was in a more serious state than initially thought.

Diagnostic interval

Other diagnoses A prominent theme identified in the diagnostic interval was the participants' perception that their symptoms had been misdiagnosed, either once or multiple times. Common misdiagnoses included haemorrhoids, menopause, diverticulitis, vitamin B12 deficiency, low iron, diabetes, stress, anxiety, irritable bowel syndrome, kidney stones and food poisoning, with GPs typically prescribing medication for these.

> *Symptoms probably were, around about 10 months prior, um, to finally being diagnosed, and I'd been to my GP quite a few times of that 10 months period with my concerns, and his first comment was, you know 'it's probably just piles, you've probably just got piles.' And I said 'look, I've had them before, I know what pile bleeding is' … I said, 'This is quite a lot of blood'. (Female, stage 3)*

> *I went back to the doctor and I said I'm a little bit concerned you know I've got this weight loss and I can't understand it. I'm still eating. Although I don't have a great appetite. But um, I'm noticing there's blood in my stools. And he said to me 'oh, do you think you might have piles?' (Female, stage 4)*

> *He [doctor] just thought I had irritable bowel syndrome and gave me medication for that which actually made me sick. (Female, stage 3)*

Other diagnoses were reported more often by participants who experienced linger diagnostic intervals (excluding those who were diagnosed incidentally) and therefore was an important barrier to prompt diagnosis.

Patient appraisal of GP Participants typically appraised their GPs performance throughout the diagnostic interval. If they perceived a high level of technical competence (i.e., medical knowledge, performing a physical examination, being proactive, following up on referrals) a positive diagnostic experience was reported, but if participants perceived a poor level of technical competence, then they were more likely to report a negative diagnostic experience.

Participants universally reported a positive experience if their GP investigated symptoms proactively, leading to

a prompt diagnosis. For example, some participants praised GPs for having a high level of CRC knowledge (recognising symptoms) and taking the initiative in providing healthcare (referring for colonoscopies / blood tests and calling participants for routine check-ups). One person perceived a high level of technical competence from their GP:

I did go to my GP. And um, she did some blood tests and I was extra low in iron. So she gave me some iron. Um which made me feel a whole lot better. But in, in between times, she had already written to have a colonoscopy for me to have at [hospital]. Yeah so it's, she obviously suspected something wasn't quite right, you know, for losing all that iron out of my body so, yeah. So she then, got things cracking and she really did. (Female, stage 3)

While the perception of a technically competent GP was associated with prompt diagnosis, a perceived lack of technical competence was an important barrier to diagnosis. For example, a lack of technical competence was perceived if GPs failed to perform appropriate medical examinations before offering a diagnosis. Several participants reported a lack of scans or rectal examinations:

And I was sent home because she said I had constipation … no scan, no nothing. (Female, stage 3)

He seemed to think I had piles, although he didn't check. He never once, he never once examined me at all. Which I thought was really odd. (Female, stage 4)

But, I- in some ways, I think my doctor did fail, yeah, by lack of checking...he could have checked for haemorrhoids. (Female, stage 4)

In addition to the perception of technical competence, participants also assessed their GPs level of interpersonal competence based on their experiences of feeling respected, informed and cared about. Participants who reported having an overall positive diagnostic experience also perceived their GP to have a high level of interpersonal competence. Interestingly, interpersonal competence could often override perceptions about technical competence and a longer interval to diagnosis, and could still lead to a positive diagnostic experience:

*And in the interim again [waiting for non-urgent colonoscopy] we tried to- still tried to identify triggers and we tried to get another anti-nausea thing, that type of thing. Yeah so the on-going care, was, was happening, but not effective … So then, J*** who's my GP, said okay well let's try some, we will do some more blood tests etc and this time they did, an iron test … I've got the same GP I've been seeing for years, yeah, very, very good. (Male, stage unknown)*

He [doctor] said 'you are under my care'. And that made a big difference, because it showed that somebody actually did care. I wasn't just a number. (Female, stage 4)

In contrast, a failure to demonstrate interpersonal competence generated a negative diagnostic experience:

He just didn't really care, wasn't interested and just, look-looked me up and down and just kept typing on his, on the computer. (Female, stage 3)

For one person, despite having received five earlier non-cancer diagnoses, experiencing a longer interval to diagnosis and cancer progression, it was the perceived lack of interpersonal competence that had the most negative impact:

I stood at the reception and I, was actually treated quite disrespectfully, through this whole journey. Even by the receptionist because I think, I think they thought I was a hypochondriac … [So I said tell the doctor] I won't be in for my B12 shot next week because I, I'm, I don't have B12 deficiency. I have cancer. And I've never heard from them. Not an apology. Not a letter. Nope, nothing … and I just feel sorry for anybody else that's been treated by him because we were just. We were just, I, you know I, I really feel that. Um, that particular company, just, get you in and out. Here's some drugs, bugger off. We really don't care. You know? And so all through this, I actually started seeing, I went and got counselling. (Female, stage 4)

While many of the participants described GP delays as frustrating or worrying, their more emotional descriptions of poor care tended to include incidences where they felt dismissed, ignored or disrespected.

Discussion

This study sheds light on the barriers and facilitators experienced by CRC patients who either did or did not experience a longer interval to diagnosis. For all the non-Māori symptomatic participants, the perception of an abnormal or previously unexperienced CRC symptom acted as a key facilitator to help-seeking behaviours. However, there was a barrier for some Māori participants who appraised their symptoms according to whether they were perceptible to their work colleagues

or family. For all participants, self-managing and normalising symptoms acted as a barrier as no alarm was experienced. Symptoms worsening and an increasing inability to perform routine daily activities was identified as a key facilitator for the majority of symptomatic participants. This was particularly the case for Māori participants, who focused on their desire to involve their children as they made the decision to seek medical help. Other diagnoses being offered before clinical investigations, and a patient-appraised lack of GP technical competence acted as barriers to a prompt CRC diagnosis, whilst in contrast, a perceived high level of technical competence was found to be a facilitator to diagnosis. The perception of interpersonal competence was found to be a key facilitator to diagnosis and dictated the overall positive or negative GP-patient experience.

The symptoms experienced by participants align with the current international literature [18] however, participants in this study reported that the worsening of symptoms had an additional psychosocial effect (inability to socialise, perform employment tasks, or holiday adequately) which acted as a facilitator to consulting a GP. This additional effect is not one that is defined nor measured during a GP consultation, it was found to be a significant facilitator to CRC diagnosis. Further, Māori participants clearly identified the sociocultural context as central to their decision making about whether symptoms were severe enough to warrant medical investigation. This represents an important opportunity for improving cultural safety communication in primary health care if GPs recognise help-seeking behaviour as an indicator of significant patient distress. Further investigation into communication discrepancies is necessary to ensure any potential delays are reduced in this stage of the CRC diagnostic process by developing an understanding of what drives people to seek medical help.

Failure to examine the patient was found to be a significant barrier to CRC diagnosis, and generated a negative overall experience. Participants perceived the absence of physical examinations (commonly for haemorrhoids) as a demonstration of a lack of technical competence in their GPs. This was further evidenced by the participant receiving a diagnosis of 'piles' along with prescribed medication, both of which contributed to a longer diagnostic interval. A combination of GP professional processes of diagnosing (differential diagnosis) with the way in which symptoms of CRC are commonly found to be present with other benign bowel diseases could offer a potential explanation as to why non-cancer diagnoses were offered. The appraisal of GP competence is a complex finding, nonetheless, further investigation, and improved access to diagnostic procedures such as colonoscopy for GPs is needed, especially considering the suggestion that NZ GPs have generally more limited access compared to other countries [19].

Interpersonal competence was significant in all patient narratives and dictated whether participants had a positive or negative diagnostic experience. Interestingly, a GP displaying high levels of interpersonal competence could override poor technical competence in producing an overall positive diagnostic experience, even when the cancer was advanced. This finding indicates that interpersonal competence is more important to the patient than technical competence during the diagnostic process. However, the GP-patient relationship was significantly weakened if the GP was appraised as being technically incompetent in addition to not communicating that they cared about the patient.

Comparison to other literature

This study supports previous literature which indicates that barriers to CRC diagnosis are influenced by the nature of CRC symptoms and the individualised symptom experience [9, 18, 20] along with health literacy levels [21]. However, this study opposes the perspective that patients misinterpret their symptoms [9] which leads to a longer diagnostic interval. Instead, this study offers evidence that patients misattribute, not misinterpret, their CRC symptoms. The definition and measurement of CRC symptoms in some cases do not align. Clear communication in GP-patient consultations is significant and supports previous literature that unclear communication could be an influencing factor between early and late stage diagnosis [10]. In the cases where the symptom definition between patient and GP aligned, the attribution was towards CRC by GPs and non-CRC by patients.

Facilitators to GP consultation and CRC diagnosis identified in this study also support previous literature. Normalising of symptoms by participants acted as a barrier and delayed help-seeking [22]. Symptoms becoming alarming (bleeding from bowel [23]), symptoms becoming unmanageable and a routine disruption were all reported by patients to be key facilitators to GP consultation [12, 15, 18]. This study also offers the perspective of Māori participants, indicating the central position of the sociocultural environment during the symptom appraisal and help-seeking intervals. Clear differences in how indigenous peoples view symptoms and cancer care has also been shown for Aboriginal people in Australia [24]. As found in other NZ studies [25], the GP was the most common point of contact for patients seeking help for CRC symptoms and is seen as crucial for clear CRC information and communication [26, 27]. This competence appraisal strengthened or weakened the GP-patient relationship, which offers support for previous literature that demonstrates trust and positive GP-

patient relationships are key facilitators in CRC diagnosis and treatment [10, 27, 28].

Implications

Overall, the findings from this research hold broader implications relating to the health promotion, health campaign, and CRC symptom education contexts in NZ. Tailoring CRC health messages and information to the non-clinical and culturally diverse audience is crucial for CRC symptoms to be recognised and diagnosed quicker, as recommended by previous literature [23, 29]. This study recommends that CRC health campaigns that ask if one has anaemia will not have any contextual meaning to a non-clinical individual. Instead, this research suggests asking if one is too tired to carry out their normal daily activities, or if their routine has changed due to bowel habits, as this could be a more effective way of generating CRC symptom awareness in individuals and communities with no clinical terminology knowledge. This 'culturally diverse' messaging should have a particular focus on Māori and Pacific groups to eliminate inequities in CRC outcomes. A further strategy to emerge from this study is to heighten GPs understanding of the complex appraisal and psychological processes patients go through before seeking a consultation to avoid colluding with incorrect interpretation of symptoms (e.g., the normalising of symptoms). Building awareness across the community would also contribute to GPs being consulted quicker. Having a medical workforce that is more appreciative of the effort it takes many patients to seek help will also make them more likely to listen to what may appear as vague symptoms. These together will enable CRC diagnosis to occur at earlier stages and likely reduce CRC deaths in NZ.

In addition, a key message is the importance of interpersonal and technical competence. Minimising the perception of a lack of technical or interpersonal competence could strengthen GP-patient relationships. Consequently, this could reduce the amount of reported complaints to the Health Commissioner about GPs failure to examine or adequately perform GP duties in the future.

Strengths/future directions

A major strength of this study was that the patient was enabled the space to speak about their diagnostic experience from their perspective, with Māori participants able to contribute their stories in a culturally safe manner. Whilst this is a qualitative study and findings cannot be generalised, the findings support the broader quantitative research project by providing a more comprehensive understanding of the appraisal, help-seeking and diagnostic intervals that lead to CRC diagnosis. Another strength was the range of participants included in this project, including age, gender, cancer stage and geographical location across the Waikato. Future directions could include a more focussed investigation into (1) the differences in CRC symptom discourse between clinical and non-clinical perspectives and (2) the experiences and processes employed for self-treatment by individuals, as this research identified these two contexts to be significant in the CRC diagnosis experience.

Conclusion

The findings of this study help to understand the lived experience of the CRC diagnosis in the NZ population as well as identify barriers and facilitators present in the diagnostic experience. These findings indicate a significance of tailored CRC symptom communication in any future health campaigns, as well as indicating the significance of the interpersonal competence aspect of GP-patient interaction, which can generate a positive diagnostic experience despite delays in diagnosis and repeated misdiagnosis. These findings suggest that interpersonal competence be overtly displayed in all GP interactions to ensure a higher likelihood of a positive GP experience for the patient.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s12875-020-01276-w.

Additional file 1. Supplementary material. COREQ Checklist. Completed COREQ checklist.

Additional file 2. Supplementary material. Interview guide. Interview guide used.

Abbreviations

NZ: New Zealand; CRC: Colorectal cancer; GP: General practitioner; MPT: The Model of Pathways to Treatment; DHB: District health board; ED: Emergency department; COBH: Changes of bowel habit

Acknowledgements

We would like to acknowledge the participants of the study who gave their time in providing the data.

Authors' contributions

TB, JK and KN wrote the main manuscript. SC, JK and KN conducted the data analysis. RL contributed to the study design. LC, RK, MF, CJ, TS, DW, and JE provided clinical input. All authors read and reviewed the final manuscript.

Funding

This work was supported by the Health Research Council of New Zealand (HRC grant number 17/147). The funder had no role in the study design, the collection, analysis and interpretation of data or in writing the manuscript.

Availability of data and materials

The data analysed for the current study are not publically available for ethical reasons. Anonymised data can be made available from the corresponding author on request.

Ethics approval and consent to participate

Ethical approval for this study was granted by the New Zealand Health and Disability Ethics Committee (Ref: 17/NTB/156). All participants provided written and verbal consent prior to participation in the study.

Consent for publication

Not required.

Competing interests
The authors declare no competing interests.

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Received: 15 May 2020 Accepted: 23 September 2020
Published online: 01 October 2020

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Publisher's Note

APPENDIX 9

Evidence of inequitable use of chemotherapy in New Zealand colorectal cancer patients

Chunhuan Lao, Marion Kuper-Hommel, George Laking, Lynne Chepulis, Ross Lawrenson

ABSTRACT

AIMS: To explore variations in the use of and timeliness of chemotherapy in patients diagnosed with colorectal cancer in New Zealand.

METHODS: This study included patients diagnosed with colorectal cancer in New Zealand between 1 January 2006 and 31 December 2016. The first chemotherapy regime was identified from Pharmaceutical Collection dataset. Logistic regression model was used to estimate the adjusted odds ratio of having chemotherapy by subgroup after adjustment for other factors.

RESULTS: 27.8% (6,737/24,217) of colon cancer patients and 43.8% (3,582/8,170) of rectal cancer patients received publicly funded chemotherapy. The uptake and timeliness of chemotherapy has been improving over time. Pacific people were the least likely to receive chemotherapy, followed by Māori and Asian. Younger patients, New Zealand European, patients with metastatic disease and patients in the Southern Cancer Network were more likely to have chemotherapy in less than 10 weeks post-diagnosis. Over half of the advanced colorectal cancer patients who did not receive chemotherapy were aged 80+ years or had a short life expectancy.

CONCLUSIONS: Although the uptake and timeliness of chemotherapy for colorectal cancer has been improving, Māori, Pacific, Asian and older patients were less likely to receive chemotherapy and less likely to receive chemotherapy in a timely manner. There is a variation in use of chemotherapy by Region with patients in the Southern Cancer region appearing to be the most likely to receive chemotherapy and to receive it within a timely period.

New Zealand has one of the highest incidence rates of colorectal cancer in the world, and has higher colorectal cause-specific mortality than Australia.[1,2]

The most effective intervention to improve survival after diagnosis of colorectal cancer is surgery. For many patients, survival can be further increased when chemotherapy is added to surgery, so-called "adjuvant" treatment. It can reduce the risk of recurrence.[5] Some patients also have neoadjuvant chemotherapy prior to surgery to shrink the tumour.[6] For metastatic disease, surgery is used to prevent blockage and chemotherapy is given as palliative treatment to prolong survival but not as a cure.[7] The publicly funded chemotherapy regimens for colorectal cancer in New Zealand included bolus / infusional 5-fluorouracil [5-FU] as monotherapy or combination chemotherapy including FOLFOX (5-FU, calcium folinate and oxaliplatin), FOLFIRI (5-FU, calcium folinate and irinotecan), FOLFOXIRI (5-FU, calcium folinate, oxaliplatin and irinotecan), capecitabine and the combination of capecitabine and oxaliplatin (CapOx).[8–10]

The timeliness of chemotherapy has become an increasingly important question in the management of colorectal cancer.[11–13] The Standards of Service Provision for Bowel Cancer Patients in New Zealand recommends that patients' post-operative

chemotherapy starts within four weeks of surgical resection.[14] In a meta-analysis of 10 studies on time to start of chemotherapy, longer time to chemotherapy was shown to be associated with worse survival among patients with resected colorectal cancer.[11] It showed that a four-week delay to chemotherapy could result in a significant decrease in both overall survival (Hazard ratio, 1.14; 95% confidence interval [CI], 1.10–1.17) and cancer-free survival (Hazard ratio, 1.14; 95% CI, 1.10–1.18).[11]

New Zealand has a free-at-the-point of use public health service that purports to offer near universal coverage to all residents. There is an increasing body of evidence that access to diagnosis and treatment in New Zealand's health service is inequitably distributed, with Māori at a particular disadvantage. To measure the quality of care and outcomes for people with colorectal cancer in New Zealand and to present opportunities for improving services or care pathways and reducing inequity, the Ministry of Health completed a bowel cancer quality improvement report in 2019.[15] It investigated the diagnostic pathway, surgical treatment and radiation therapy, but did not audit the use of chemotherapy. Thus, this study aims to explore the use and timeliness of chemotherapy in patients diagnosed with colorectal cancer in New Zealand.

Material and methods

This study included patients diagnosed with colorectal cancer in New Zealand between 1 January 2006 and 31 December 2016, as recorded in the New Zealand Cancer Registry (NZCR). The NZCR was linked to the Pharmaceutical Collection (PHARMS) dataset by National Health Index (NHI) number to identify the publicly funded chemotherapy regimes in 2006–2017. The NHI number is a unique identifier for people who use publicly funded health and disability services in New Zealand. The PHARMS dataset stores claim and payment information from pharmacists for publicly subsidised dispensings. The combined dataset consisted of: 1) patient demographics: date of birth, gender and ethnicity; 2) tumour characteristics: date of diagnosis, cancer site, cancer extent and number of positive lymph nodes; and 3) medication dispensing information: chemical name, brand name, date of dispensing and quantity dispensed. The cancer extent recorded in the NZCR used the Surveillance Epidemiology and End Results (SEER) programme (A: localised within organ wall, B: limited to organ of origin, C: extension to adjacent organs, D: extension to regional lymph nodes and E: distant metastases).[4] While the New Zealand Cancer Registry do have some T, N and M staging data, this is far from complete, while 81% of the colorectal cancer patients had SEER cancer extent information available. Consequently we have used the SEER cancer extent information in our analyses.

The publicly funded regimes of chemotherapy for colorectal cancer were grouped to FOLFOX, FOLFIRI, 5-FU with calcium folinate, capecitabine, CapOx and others. The first chemotherapy regime within 12 months post-colorectal cancer diagnosis was identified from the medication dispensing records as the primary chemotherapy regime. Because we could not ascertain whether the chemotherapy was for primary colorectal cancer or regional / distant recurrence, we used within one year post-diagnosis as time cut-off to identify the primary chemotherapy regime for the primary colorectal cancer. Timeliness of the chemotherapy was stratified into five groups: 1) less than five weeks after cancer diagnosis, 2) ≥5 weeks and <10 weeks, 3) ≥10 weeks and < 15 weeks, 4) ≥15 weeks and <20 weeks, and 5) 20+ weeks post-diagnosis. Surgery dates were not available to examine the relationship of surgery with timeliness of chemotherapy.

Use of different chemotherapy regimes and timeliness of chemotherapy was described by gender, age group (<60, 60–64, 65–69, 70–74, 75–79, 80–84 and 85+ years), ethnicity (New Zealand European, Māori, Pacific, Asian and others), cancer extent, cancer grade (1–4), lymph node (had positive lymph nodes, no positive lymph node), year of diagnosis and cancer network (Northern, Mid Central, Midland and Southern Cancer Network). The analysis was stratified by site of cancer (colon cancer and rectal cancer). Subgroup differences were examined with Chi-square test. Logistic regression model was used to estimate the odds ratio of having chemotherapy by subgroup after adjustment for gender, age, ethnicity, deprivation quintile (NZDep2013), year of diagnosis, cancer

extent, grade and cancer network. To identify possible reasons for not having chemotherapy, we examined patients diagnosed with advanced colorectal cancer who had no chemotherapy by age and follow-up time before death. Of the patients who had chemotherapy, we also estimated the adjusted odds ratio of having chemotherapy in less than 10 weeks post-diagnosis by subgroup after adjustment for gender, age, ethnicity, deprivation quintile, year of diagnosis, cancer extent, grade and cancer network.

All data analyses were performed in IBM SPSS statistics 25 (New York, US). The study is covered under ethics approval from the Health and Disability Ethics Committee (HDEC)—Approval Number: 17/NTB/156.

Results

During the study period 6,737/24,217 (27.8%) of patients diagnosed with colon cancer received publicly funded chemotherapy (Table 1) and 3,582/8,170 (43.8%) of patients with rectal cancer (Table 2). The proportion of patients having chemotherapy increased with cancer extent and grade. The use of chemotherapy decreased with increasing age, with only 4.4% of colon cancer patients aged 80+ years and 8.6% rectal cancer patients aged 80+ years receiving chemotherapy.

The pattern of chemotherapy regimes varied by subgroup. Older patients were more likely to receive Capecitabine and 5-FU, and younger patients were more likely to receive CapOx and FOLFOX. Patients with advanced cancer and patients with positive lymph nodes were more likely to have CapOx. The use of Capecitabine has been increasing over time, while the use of 5-FU has been reducing. CapOx were more commonly used in the Mid Central Cancer Network than in other cancer networks.

After adjustment for age, ethnicity, year of diagnosis, cancer extent, grade and cancer network (Table 3), men were more likely to have chemotherapy than women (OR1.19 for colon cancer; 1.31 for rectal cancer). There were also ethnic differences, with Pacific people being the least likely to receive chemotherapy after adjustment for gender, age, deprivation quintile, year of diagnosis, cancer extent, grade and cancer network (OR compared to Europeans: 0.47 for colon cancer; 0.63 for rectal cancer), followed by Māori (OR: 0.63 for colon cancer; 0.85 for rectal cancer) and Asian (OR: 0.69 for colon cancer; 0.79 for rectal cancer).

For patients with extent D and E colon cancer not receiving chemotherapy, 44.4% (2547/5734) were aged 80+ years, and another 15.9% (914/5,734) were aged less than 80 years but died within three months post-diagnosis. For extent D and E rectal cancer patients not receiving chemotherapy, 34.9% (390/1,116) of them were aged 80+ years, and another 16.2% (181/1,116) of patients were aged less than 80 years and died within three months post-diagnosis.

More than half of patients commenced their chemotherapy within the first 10 weeks post-diagnosis (Table 4 and 5), with around a quarter of the patients with metastatic disease starting chemotherapy within the first five weeks. The likelihood of starting chemotherapy in less than 10 weeks post-diagnosis has been increasing over time, with an adjusted odds ratio of 1.11 for colon cancer and 1.19 for rectal cancer (Table 6). Younger patients, New Zealand Europeans, patients with metastatic disease and patients in the Southern Cancer Network were more likely to have chemotherapy earlier.

Discussion

This study found that the use of chemotherapy in patients with colorectal cancer is not only influenced by the site and stage of disease but that there are also variations due to age, gender, ethnicity and the centre where treatment is provided. It is important to constantly review our management of cancer to ensure that New Zealand patients have equitable access to care. This study shows that despite the limitations of not having detailed individual clinical data, that routinely collected data can provide useful information when records are linked. In particular the comprehensive New Zealand Pharmaceutical data site provides valuable information on the use of chemotherapy for cancer patients in the absence of a prospectively collected registers of chemotherapy treatment. The findings from this study are consistent with those of the PIPER study—a retrospective study of 5,594 patients with colorectal cancer. Thus this study shows that overall 43.2% (2,836/6,559) of metastatic colorectal cancer patients received chemotherapy within one year after cancer

Table 1: Use of publicly funded chemotherapy for colon cancer patients by subgroup.

Subgroup	Had chemotherapy		P-value	First chemotherapy regime after diagnosis													Total
				Capecitabine		CapOx		5-FU		FOLFIRI		FOLFOX		Others		P-value	
Gender																	
Female	3,204	25.8%	<0.001	1,088	34.0%	914	28.5%	491	15.3%	149	4.7%	513	16.0%	49	1.5%	0.498	12,411
Male	3,533	29.9%		1,110	31.4%	1,057	29.9%	570	16.1%	182	5.2%	553	15.7%	61	1.7%		11,806
Age group																	
<50	784	53.8%	<0.001	177	22.6%	296	37.8%	69	8.8%	35	4.5%	195	24.9%	12	1.5%	<0.001	1,457
50–59	1,207	48.2%		289	23.9%	440	36.5%	137	11.4%	76	6.3%	243	20.1%	22	1.8%		2,505
60–69	2,318	43.2%		615	26.5%	808	34.9%	340	14.7%	129	5.6%	371	16.0%	55	2.4%		5,367
70–79	2,124	26.6%		932	43.9%	417	19.6%	428	20.2%	80	3.8%	246	11.6%	21	1.0%		7,972
80+	304	4.4%		185	60.9%	10	3.3%	87	28.6%	11	3.6%	11	3.6%		0.0%		6,916
Ethnicity																	
Asian	221	32.6%	<0.001	68	30.8%	75	33.9%	24	10.9%	10	4.5%	44	19.9%		0.0%	0.003	678
European	5,864	27.3%		1,980	33.8%	1,671	28.5%	930	15.9%	290	4.9%	893	15.2%	100	1.7%		21,514
Māori	423	33.9%		93	22.0%	139	32.9%	74	17.5%	27	6.4%	82	19.4%	8	1.9%		1,248
Pacific	131	32.0%		26	19.8%	58	44.3%	16	12.2%	2	1.5%	27	20.6%	2	1.5%		409
Others	98	26.6%		31	31.6%	28	28.6%	17	17.3%	2	2.0%	20	20.4%		0.0%		368
Cancer extent																	
B: Limited to organ of origin	208	3.5%	<0.001	76	36.5%	40	19.2%	62	29.8%	8	3.8%	21	10.1%	1	0.5%	<0.001	5,964
C: Extension to adjacent organs	441	10.8%		216	49.0%	53	12.0%	125	28.3%	8	1.8%	35	7.9%	4	0.9%		4,066
D: Extension to regional lymph nodes	3,457	56.2%		1,182	34.2%	1,087	31.4%	593	17.2%	49	1.4%	509	14.7%	37	1.1%		6,149
E: Distant metastases	2,252	42.5%		537	23.8%	724	32.1%	228	10.1%	238	10.6%	461	20.5%	64	2.8%		5,294
F: Unknown	379	13.8%		187	49.3%	67	17.7%	53	14.0%	28	7.4%	40	10.6%	4	1.1%		2,744
Cancer grade																	
1	400	19.0%	<0.001	140	35.0%	96	24.0%	83	20.8%	12	3.0%	60	15.0%	9	2.3%	<0.001	2,105
2	3,949	30.1%		1,359	34.4%	1,227	31.1%	588	14.9%	155	3.9%	567	14.4%	53	1.3%		13,121
3	1,342	36.2%		398	29.7%	393	29.3%	224	16.7%	82	6.1%	229	17.1%	16	1.2%		3,706
4	197	39.3%		67	34.0%	50	25.4%	22	11.2%	10	5.1%	46	23.4%	2	1.0%		501
Unknown	849	17.7%		234	27.6%	205	24.1%	144	17.0%	72	8.5%	164	19.3%	30	3.5%		4,784
Lymph nodes																	
No positive lymph node	938	9.4%	<0.001	387	41.3%	177	18.9%	228	24.3%	34	3.6%	102	10.9%	10	1.1%	<0.001	10,024
Had positive lymph nodes	4,344	58.1%		1,361	31.3%	1,426	32.8%	670	15.4%	140	3.2%	690	15.9%	57	1.3%		7,480
Unknown	1,455	21.7%		450	30.9%	368	25.3%	163	11.2%	157	10.8%	274	18.8%	43	3.0%		6,713
Year of diagnosis																	
2006–2009	2,047	24.5%	<0.001	624	30.5%	488	23.8%	589	28.8%	63	3.1%	208	10.2%	75	3.7%	<0.001	8,351
2010–2013	2,677	30.2%		879	32.8%	897	33.5%	305	11.4%	147	5.5%	432	16.1%	17	0.6%		8,860
2014–2016	2,013	28.7%		695	34.5%	586	29.1%	167	8.3%	121	6.0%	426	21.2%	18	0.9%		7,006
Cancer network																	
Northern	1,887	26.2%	0.001	730	38.7%	545	28.9%	273	14.5%	13	0.7%	295	15.6%	31	1.6%	<0.001	7,213
Mid Central	1,370	29.2%		504	36.8%	628	45.8%	88	6.4%	46	3.4%	88	6.4%	16	1.2%		4,696
Midland	1,452	28.3%		334	23.0%	157	10.8%	325	22.4%	235	16.2%	378	26.0%	23	1.6%		5,138
Southern	2,028	28.5%		630	31.1%	641	31.6%	375	18.5%	37	1.8%	305	15.0%	40	2.0%		7,125
Unknown	0	0.0%															45
Total	**6,737**	27.8%		**2,198**	32.6%	**1,971**	29.3%	**1,061**	15.7%	**331**	4.9%	**1,066**	15.8%	**110**	1.6%		**24,217**

Table 2: Use of chemotherapy for rectal cancer patients by subgroup.

Subgroup	Had chemotherapy		P-value	First chemotherapy regime after diagnosis													Total
				Capecitabine		CapOx		5-FU		FOLFIRI		FOLFOX		Others		P-value	
Gender																	
Female	1,255	40.1%	<0.001	709	56.5%	151	12.0%	271	21.6%	32	2.5%	81	6.5%	11	0.9%	<0.001	3,126
Male	2,327	46.1%		1,260	54.1%	296	12.7%	558	24.0%	63	2.7%	129	5.5%	21	0.9%		5,044
Age group																	
<50	499	67.3%	<0.001	272	54.5%	80	16.0%	91	18.2%	8	1.6%	43	8.6%	5	1.0%	<0.001	742
50–59	810	62.1%		418	51.6%	117	14.4%	183	22.6%	25	3.1%	57	7.0%	10	1.2%		1,304
60–69	1,227	54.8%		656	53.5%	185	15.1%	267	21.8%	35	2.9%	71	5.8%	13	1.1%		2,240
70–79	914	38.9%		533	58.3%	64	7.0%	252	27.6%	25	2.7%	36	3.9%	4	0.4%		2,350
80+	132	8.6%		90	68.2%	1	0.8%	36	27.3%	2	1.5%	3	2.3%		0.0%		1,534
Ethnicity																	
Asian	149	46.1%	<0.001	90	60.4%	20	13.4%	26	17.4%	3	2.0%	9	6.0%	1	0.7%	<0.001	323
European	2,938	42.7%		1,623	55.2%	373	12.7%	689	23.5%	66	2.2%	161	5.5%	26	0.9%		6,873
Māori	294	52.3%		139	47.3%	31	10.5%	78	26.5%	19	6.5%	24	8.2%	3	1.0%		562
Pacific	133	50.2%		74	55.6%	14	10.5%	24	18.0%	5	3.8%	14	10.5%	2	1.5%		265
Others	68	46.3%		43	63.2%	9	13.2%	12	17.6%	2	2.9%	2	2.9%		0.0%		147
Cancer extent																	
B: Limited to organ of origin	83	5.0%	<0.001	36	43.4%	9	10.8%	27	32.5%	2	2.4%	7	8.4%	2	2.4%	<0.001	1,660
C: Extension to adjacent organs	97	17.7%		57	58.8%	8	8.2%	28	28.9%	1	1.0%	3	3.1%		0.0%		549
D: Extension to regional lymph nodes	845	61.2%		380	45.0%	191	22.6%	186	22.0%	6	0.7%	68	8.0%	14	1.7%		1,380
E: Distant metastases	584	50.1%		186	31.8%	147	25.2%	78	13.4%	64	11.0%	98	16.8%	11	1.9%		1,165
F: Unknown	1,973	57.8%		1,310	66.4%	92	4.7%	510	25.8%	22	1.1%	34	1.7%	5	0.3%		3,416
Cancer grade																	
1	255	33.1%	<0.001	145	56.9%	22	8.6%	65	25.5%	5	2.0%	16	6.3%	2	0.8%	<0.001	771
2	2,291	46.3%		1,343	58.6%	281	12.3%	473	20.6%	51	2.2%	130	5.7%	13	0.6%		4,949
3	405	52.1%		187	46.2%	66	16.3%	101	24.9%	15	3.7%	28	6.9%	8	2.0%		777
4	43	48.3%		29	67.4%	2	4.7%	5	11.6%	1	2.3%	5	11.6%	1	2.3%		89
Unknown	588	37.1%		265	45.1%	76	12.9%	185	31.5%	23	3.9%	31	5.3%	8	1.4%		1,584
Lymph nodes																	
No positive lymph node	169	9.9%	<0.001	72	42.6%	25	14.8%	53	31.4%	3	1.8%	15	8.9%	1	0.6%	<0.001	1,715
Had positive lymph nodes	678	58.6%		252	37.2%	193	28.5%	145	21.4%	12	1.8%	63	9.3%	13	1.9%		1,157
Unknown	2,735	51.6%		1,645	60.1%	229	8.4%	631	23.1%	80	2.9%	132	4.8%	18	0.7%		5,298
Year of diagnosis																	
2006–2009	1,055	38.2%	<0.001	323	30.6%	147	13.9%	506	48.0%	15	1.4%	44	4.2%	20	1.9%	<0.001	2,762
2010–2013	1,365	45.9%		830	60.8%	172	12.6%	250	18.3%	33	2.4%	72	5.3%	8	0.6%		2,977
2014–2016	1,162	47.8%		816	70.2%	128	11.0%	73	6.3%	47	4.0%	94	8.1%	4	0.3%		2,431
Cancer network																	
Northern	1,052	41.4%	0.024	674	64.1%	131	12.5%	175	16.6%	9	0.9%	52	4.9%	11	1.0%	<0.001	2,539
Mid Central	740	44.6%		494	66.8%	134	18.1%	72	9.7%	13	1.8%	21	2.8%	6	0.8%		1,659
Midland	726	45.1%		284	39.1%	24	3.3%	276	38.0%	69	9.5%	68	9.4%	5	0.7%		1,609
Southern	1,063	45.3%		516	48.5%	158	14.9%	306	28.8%	4	0.4%	69	6.5%	10	0.9%		2,346
Unknown	1	5.9%		1	100.0%												17
Total	**3,582**	43.8%		**1,969**	55.0%	**447**	12.5%	**829**	23.1%	**95**	2.7%	**210**	5.9%	**32**	0.9%		**8,170**

Table 3: Adjusted odds ratio of having chemotherapy by logistic regression.

Factors	Colon cancer				Rectal cancer			
	p-value	odds ratio	95% CI		p-value	odds ratio	95% CI	
Gender								
Female	Ref				Ref			
Male	<0.001	1.19	1.11	1.28	<0.001	1.31	1.17	1.47
Age (continuous)	<0.001	0.92	0.91	0.92	<0.001	0.92	0.92	0.93
Ethnicity								
European	Ref				Ref			
Māori	<0.001	0.63	0.54	0.74	0.145	0.85	0.68	1.06
Pacific	<0.001	0.47	0.36	0.62	0.004	0.63	0.46	0.87
Asian	<0.001	0.69	0.55	0.86	0.115	0.79	0.59	1.06
Others	0.012	0.67	0.49	0.92	0.969	0.99	0.64	1.54
Year (continuous)	<0.001	1.06	1.05	1.07	<0.001	1.06	1.04	1.08
Extent								
B: Limited to organ of origin	Ref				Ref			
C: Extension to adjacent organs	<0.001	4.31	3.59	5.19	<0.001	5.45	3.91	7.60
D: Extension to regional lymph nodes	<0.001	64.90	54.96	76.63	<0.001	47.71	36.53	62.31
E: Distant metastases	<0.001	39.96	33.75	47.30	<0.001	28.05	21.35	36.84
Grade								
1	<0.001	0.55	0.47	0.63	<0.001	0.62	0.50	0.77
2	Ref				Ref			
3	0.070	0.91	0.83	1.01	0.157	0.88	0.73	1.05
4	0.907	0.99	0.78	1.24	0.447	0.82	0.50	1.36
Cancer network								
Northern	Ref				Ref			
Mid Central	0.018	1.14	1.02	1.27	0.148	1.13	0.96	1.32
Midland	<0.001	1.21	1.08	1.34	0.007	1.25	1.06	1.47
Southern	0.003	1.16	1.05	1.28	<0.001	1.30	1.12	1.51
Deprivation quintile								
1	Ref				Ref			
2	0.695	0.98	0.87	1.10	0.942	0.99	0.83	1.20
3	0.638	0.97	0.87	1.09	0.553	0.95	0.79	1.13
4	0.024	0.87	0.78	0.98	0.067	0.85	0.71	1.01
5	<0.001	0.78	0.69	0.88	0.319	0.91	0.76	1.09

Table 4: Timing of chemotherapy for colon cancer.

Subgroup	<5 weeks		≥5 weeks & <10 weeks		≥10 weeks & <15 weeks		≥15 weeks & <20 weeks		20+ weeks		P-value	Total having chemotherapy
Gender												
Female	417	13.0%	1,375	42.9%	812	25.3%	296	9.2%	304	9.5%	0.212	3,204
Male	471	13.3%	1,426	40.4%	920	26.0%	370	10.5%	346	9.8%		3,533
Age group												
<50	151	19.3%	348	44.4%	178	22.7%	48	6.1%	59	7.5%	<0.001	784
50–59	169	14.0%	539	44.7%	290	24.0%	103	8.5%	106	8.8%		1,207
60–69	287	12.4%	966	41.7%	594	25.6%	242	10.4%	229	9.9%		2,318
70–79	253	11.9%	832	39.2%	595	28.0%	238	11.2%	206	9.7%		2,124
80+	28	9.2%	116	38.2%	75	24.7%	35	11.5%	50	16.4%		304
Ethnicity												
Asian	16	7.2%	84	38.0%	84	38.0%	18	8.1%	19	8.6%	<0.001	221
European	802	13.7%	2,468	42.1%	1,458	24.9%	579	9.9%	557	9.5%		5,864
Māori	51	12.1%	155	36.6%	120	28.4%	48	11.3%	49	11.6%		423
Pacific	11	8.4%	50	38.2%	41	31.3%	10	7.6%	19	14.5%		131
Others	8	8.2%	44	44.9%	29	29.6%	11	11.2%	6	6.1%		98
Cancer extent												
B: Limited to organ of origin	11	5.3%	73	35.1%	52	25.0%	28	13.5%	44	21.2%	<0.001	208
C: Extension to adjacent organs	19	4.3%	180	40.8%	107	24.3%	49	11.1%	86	19.5%		441
D: Extension to regional lymph nodes	165	4.8%	1,522	44.0%	1,072	31.0%	401	11.6%	297	8.6%		3,457
E: Distant metastases	598	26.6%	859	38.1%	441	19.6%	177	7.9%	177	7.9%		2,252
F: Unknown	95	25.1%	167	44.1%	60	15.8%	11	2.9%	46	12.1%		379
Cancer grade												
1	32	8.0%	147	36.8%	117	29.3%	49	12.3%	55	13.8%	<0.001	400
2	375	9.5%	1,656	41.9%	1,114	28.2%	411	10.4%	393	10.0%		3,949
3	174	13.0%	601	44.8%	311	23.2%	137	10.2%	119	8.9%		1,342
4	23	11.7%	99	50.3%	56	28.4%	16	8.1%	3	1.5%		197
Unknown	284	33.5%	298	35.1%	134	15.8%	53	6.2%	80	9.4%		849
Lymph nodes												
No positive lymph node	42	4.5%	356	38.0%	252	26.9%	118	12.6%	170	18.1%	<0.001	938
Had positive lymph nodes	254	5.8%	1,908	43.9%	1,309	30.1%	494	11.4%	379	8.7%		4,344
Unknown	592	40.7%	537	36.9%	171	11.8%	54	3.7%	101	6.9%		1,455
Year of diagnosis												
2006–2009	177	8.6%	746	36.4%	521	25.5%	270	13.2%	333	16.3%	<0.001	2,047
2010–2013	392	14.6%	1,135	42.4%	714	26.7%	243	9.1%	193	7.2%		2,677
2014–2016	319	15.8%	920	45.7%	497	24.7%	153	7.6%	124	6.2%		2,013
Cancer network												
Northern	800	42.4%	556	29.5%	198	10.5%	136	7.2%	197	10.4%	<0.001	1,887
Mid Central	585	42.7%	378	27.6%	142	10.4%	155	11.3%	110	8.0%		1370
Midland	487	33.5%	400	27.5%	187	12.9%	179	12.3%	199	13.7%		1,452
Southern	929	45.8%	398	19.6%	139	6.9%	418	20.6%	144	7.1%		2,028
Total	**888**	13.2%	**2,801**	41.6%	**1,732**	25.7%	**666**	9.9%	**650**	9.6%		**6,737**

Table 5: Timing of chemotherapy for rectal cancer.

Subgroup	<5 weeks		≥5 weeks & <10 weeks		≥10 weeks & <15 weeks		≥15 weeks & <20 weeks		20+ weeks		P-value	Total having chemotherapy
Gender												
Female	175	13.9%	619	49.3%	225	17.9%	105	8.4%	131	10.4%	0.891	1,255
Male	338	14.5%	1,118	48.0%	443	19.0%	187	8.0%	241	10.4%		2,327
Age group												
<50	114	22.8%	245	49.1%	47	9.4%	38	7.6%	55	11.0%	<0.001	499
50–59	122	15.1%	406	50.1%	142	17.5%	72	8.9%	68	8.4%		810
60–69	173	14.1%	593	48.3%	241	19.6%	96	7.8%	124	10.1%		1,227
70–79	98	10.7%	417	45.6%	216	23.6%	78	8.5%	105	11.5%		914
80+	6	4.5%	76	57.6%	22	16.7%	8	6.1%	20	15.2%		132
Ethnicity												
Asian	26	17.4%	72	48.3%	30	20.1%	9	6.0%	12	8.1%	0.112	149
European	432	14.7%	1,421	48.4%	543	18.5%	230	7.8%	312	10.6%		2,938
Māori	37	12.6%	141	48.0%	57	19.4%	27	9.2%	32	10.9%		294
Pacific	7	5.3%	69	51.9%	27	20.3%	16	12.0%	14	10.5%		133
Others	11	16.2%	34	50.0%	11	16.2%	10	14.7%	2	2.9%		68
Cancer extent												
B: Limited to organ of origin	12	14.5%	19	22.9%	15	18.1%	6	7.2%	31	37.3%	<0.001	83
C: Extension to adjacent organs	13	13.4%	32	33.0%	23	23.7%	15	15.5%	14	14.4%		97
D: Extension to regional lymph nodes	74	8.8%	243	28.8%	221	26.2%	172	20.4%	135	16.0%		845
E: Distant metastases	148	25.3%	235	40.2%	91	15.6%	47	8.0%	63	10.8%		584
F: Unknown	266	13.5%	1,208	61.2%	318	16.1%	52	2.6%	129	6.5%		1,973
Cancer grade												
1	34	13.3%	122	47.8%	55	21.6%	12	4.7%	32	12.5%	<0.001	255
2	298	13.0%	1,133	49.5%	437	19.1%	194	8.5%	229	10.0%		2,291
3	65	16.0%	169	41.7%	72	17.8%	46	11.4%	53	13.1%		405
4	3	7.0%	21	48.8%	8	18.6%	5	11.6%	6	14.0%		43
Unknown	113	19.2%	292	49.7%	96	16.3%	35	6.0%	52	8.8%		588
Lymph nodes												
No positive lymph node	18	10.7%	41	24.3%	44	26.0%	26	15.4%	40	23.7%	<0.001	169
Had positive lymph nodes	32	4.7%	171	25.2%	207	30.5%	147	21.7%	121	17.8%		678
Unknown	463	16.9%	1,525	55.8%	417	15.2%	119	4.4%	211	7.7%		2,735
Year of diagnosis												
2006–2009	92	8.7%	400	37.9%	245	23.2%	116	11.0%	202	19.1%	<0.001	1,055
2010–2013	210	15.4%	709	51.9%	250	18.3%	95	7.0%	101	7.4%		1,365
2014–2016	211	18.2%	628	54.0%	173	14.9%	81	7.0%	69	5.9%		1,162
Cancer network												
Northern	500	47.5%	211	20.1%	101	9.6%	132	12.5%	108	10.3%	<0.001	1,052
Mid Central	380	51.4%	137	18.5%	58	7.8%	93	12.6%	72	9.7%		740
Midland	355	48.9%	149	20.5%	62	8.5%	77	10.6%	83	11.4%		726
Southern	501	47.1%	171	16.1%	71	6.7%	211	19.8%	109	10.3%		1,063
Unknown	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%		1
Total	**513**	14.3%	**1,737**	48.5%	**668**	18.6%	**292**	8.2%	**372**	10.4%		**3,582**

Table 6: Adjusted odds ratio of having chemotherapy in less than 10 weeks by logistic regression.

Factors	Colon cancer				Rectal cancer			
	p-value	odds ratio	95% CI		p-value	odds ratio	95% CI	
Gender								
Female	Ref				Ref			
Male	0.411	0.96	0.87	1.06	0.924	1.01	0.86	1.18
Age (continuous)	<0.001	0.98	0.97	0.98	<0.001	0.98	0.97	0.98
Ethnicity								
European	Ref				Ref			
Māori	<0.001	0.68	0.55	0.85	0.145	0.81	0.62	1.07
Pacific	0.005	0.58	0.40	0.85	0.086	0.70	0.47	1.05
Asian	<0.001	0.61	0.46	0.81	0.588	0.90	0.61	1.32
Others	0.903	0.97	0.64	1.48	0.808	0.93	0.53	1.63
Year (continuous)	<0.001	1.11	1.09	1.13	<0.001	1.19	1.16	1.22
Extent								
B: Limited to organ of origin	Ref				Ref			
C: Extension to adjacent organs	0.650	1.08	0.77	1.53	0.452	1.27	0.68	2.37
D: Extension to regional lymph nodes	0.040	1.36	1.01	1.84	0.451	0.83	0.51	1.35
E: Distant metastases	<0.001	2.28	1.69	3.09	<0.001	2.34	1.42	3.84
Grade								
1	0.892	1.02	0.81	1.27	0.576	1.09	0.81	1.47
2	Ref				Ref			
3	<0.001	1.28	1.12	1.47	0.655	0.95	0.75	1.20
4	0.131	1.27	0.93	1.72	0.105	0.58	0.30	1.12
Cancer network								
Northern	Ref				Ref			
Mid Central	0.078	1.14	0.99	1.33	0.168	1.17	0.94	1.46
Midland	0.016	0.83	0.72	0.97	0.901	1.01	0.81	1.26
Southern	<0.001	1.93	1.68	2.22	<0.001	1.51	1.23	1.86
Deprivation quintile								
1	Ref				Ref			
2	0.789	0.98	0.83	1.15	0.599	1.07	0.83	1.37
3	0.764	0.98	0.83	1.15	0.978	1.00	0.78	1.27
4	0.143	0.89	0.76	1.04	0.464	0.91	0.72	1.16
5	0.149	0.88	0.74	1.05	0.410	0.90	0.71	1.15

diagnosis compared to 49% (532/1,086) in the PIPER study.[1,16] The 5% discrepancy in use of chemotherapy may be explained by the inclusion of privately funded chemotherapy agents in PIPER.

We have shown that the use of chemotherapy for patients with colorectal cancer has been increasing by 6% per year as well as showing improvements in the timeliness of treatment. The likelihood of colorectal cancer patients having chemotherapy decreased with increasing age, with only 5% of patients aged 80+ years receiving chemotherapy (10% if with extent D and 9% if extent E disease). It is well established that older cancer patients are less likely to receive chemotherapy.[17–19] Older patients have more comorbidities and poorer performance status, and are at greater risk of toxicity from chemotherapy than younger patients.[20,21]

A Denmark study showed that older patients were more frequently treated with single-agent therapy.[20] This was also found in our study, with 89.5% of colon cancer patients aged 80+ years and 95.5% of rectal cancer patients aged 80+ years receiving 5-FU or capecitabine alone as the primary chemotherapy regime. More than half of the patients with advanced colorectal cancer (extent D and E) who did not receive chemotherapy were aged 80+ years or had a short life expectancy. Age was also a barrier in timely access to chemotherapy with an adjusted odds ratio of 0.98 per year for both colon cancer and rectal cancer.

Māori, Pacific and Asian patients were less likely to receive chemotherapy for colorectal cancer. We also have noted differences in the timing of chemotherapy for Maori, Pacific and Asian patients when compared to New Zealand Europeans. This finding is consistent with the results from a local cohort study that found Māori patients with stage III colon cancer were less likely to receive chemotherapy than non-Māori patients (relative risk: 0.69; 95% CI (0.53–0.91)).[23] The findings that the variation in care applies to both colonic and rectal cancer and apply to pacific and Asian patients are of concern and suggest that the variations in care are not restricted just to the management of Māori with stage III colon cancer.

This study has also shown that there are variations in both the use and timing of chemotherapy depending on the Cancer Region where patients are treated. It seems that after adjustment for patient characteristics that patients in the Midland and Southern Region are more likely to be treated with chemotherapy. However, while patients in the Southern Region are more likely to be treated in a timely manner those in the Midland Region seem to be more likely to have delay before receiving treatment. These findings suggest that investigation of the regional variation in of surgery and radiotherapy as noted in the Bowel Cancer Quality Improvement Report can also extend to the use of chemotherapy.[15] It is worth noting that not only has the use of chemotherapy been increasing but also the time taken to start chemotherapy has been reducing. This is likely due to the effect of the faster cancer treatment programme in New Zealand which was introduced in July 2012[27] and Standards of Service Provision for Bowel Cancer Patients in December 2013.[14]

One of the strengths of this study is that it was based on national datasets with 11 years data including 30,954 colorectal cancer patients. We have showed the most recent chemotherapy usage in New Zealand, and have demonstrated the changes over time. This study has its own limitations. Firstly the National Cancer Register does have missing data on staging on almost 20% of cases so matching chemotherapy regimens to both site and stage of disease would have missed some patients. On the other hand by including all cases of cancer we can have a better overall understanding of how chemotherapy is being used in New Zealand. The PHARMS dataset collects the dispensing records of pharmaceuticals that are publicly funded, but does not records data on pharmaceuticals that are privately funded. We used a long follow-up period of one year post-diagnosis as time cut-off to try and ensure a complete recording of chemotherapy. We recognise such a time is well outside the guidelines that post-operative chemotherapy starts within four weeks of surgical resection.[14] We also did not have the data pertaining to other treatments including surgery and radiotherapy, and therefore could not discuss the relation of timeliness of chemotherapy with other treatments including surgery.

Conclusions

Chemotherapy is more likely to be used in younger patients with colorectal cancer and in men. Although the uptake and timeliness of chemotherapy for colorectal cancer has been improving, Māori, Pacific, Asian and older patients were less likely to receive chemotherapy and less likely to receive chemotherapy in less than 10 weeks post-diagnosis. There is a variation in use of chemotherapy by Region with patients in the Southern Cancer region appearing to be the most likely to receive chemotherapy and to receive it within a timely period.

Competing interests:
Dr Lawrenson reports grants from HRC during the conduct of the study; and Board Member of PHARMAC. Member of the Ministry of Health/Cancer Agency's Data Monitoring and Reporting Advisory Group.

Acknowledgements:
We would like to acknowledge this funder of this study, New Zealand Health Research Council (grant number 17/417). While the overall study has been peer reviewed by the funding body, they have had no role in the design of the study and collection, analysis and interpretation of data and or writing the manuscript.

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APPENDIX 10:

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With thanks to our research funder:

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