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**STRATEGIES TO IMPROVE ADHERENCE TO COLORECTAL
CANCER SCREENING**

Natalie Dodd

MPH, BParamedicSc

c3170154

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THESIS

DECLARATIONS

STATEMENT OF ORIGINALITY

I hereby certify that the work embodied in the thesis is my own work, conducted under normal supervision. The thesis contains no material which has been accepted, or is being examined, for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968 and any approved embargo.

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Date: 1st December 2018

Natalie Dodd

LIST OF PAPERS AND CO-AUTHOR STATEMENT OF CONTRIBUTION

By signing below I confirm that Natalie Dodd contributed substantially to manuscript conceptualisation, design, data collection, data analysis and manuscript preparation to meet lead author criteria to the papers/publications below entitled:

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A/Prof Mariko Carey_____Date: 15/10/2018

Dr Chris Oldmeadow_____Date: 15/10/2018

Faculty Assistant Dean Research Training_____Date: 15/10/2018

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Dr Elise Mansfield_____Date: 15/10/2018

A/Prof Mariko Carey_____Date: 15/10/2018

Dr Chris Oldmeadow_____Date: 15/10/2018

L/Prof Rob Sanson-Fisher_____Date: 15/10/2018

Faculty Assistant Dean Research Training_____Date: 15/10/2018

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A/Prof Mariko Carey_____Date: 15/10/2018

Dr Elise Mansfield_____Date: 15/10/2018

Dr Chris Oldmeadow_____Date: 15/10/2018

Faculty Assistant Dean Research Training Date: 15/10/2018

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A/Prof Mariko Carey Date: 15/10/2018

Dr Elise Mansfield Date: 15/10/2018

Dr Chris Oldmeadow Date: 15/10/2018

Ms Tiffany-Jane Evans Date: 15/10/2018

Faculty Assistant Dean Research Training Date: 15/10/2018

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SUPERVISORS

A/Prof Mariko Carey, DPsych. NHMRC Boosting Dementia Research Leadership Fellow, School of Medicine and Public Health, University of Newcastle.

Dr Elise Mansfield, PhD. Post-doctoral Research Fellow, School of Medicine and Public Health, University of Newcastle.

Dr Christopher Oldmeadow, PhD. Senior Statistician, Clinical Research Design, Information Technology and Statistical Support (CReDITSS), Hunter Medical Research Institute.

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ACRONYMS

AEC	Australian Electoral Commission
AIHW	Australian Institute of Health and Welfare
ANZCTR	Australian New Zealand Clinical Trials Registry
BEACH	Bettering the Evaluation and Care of Health
CBA	Controlled Before After Study
CCT	Controlled Clinical Trial
CI	Confidence Interval
CRC	Colorectal Cancer
DALY	Disability Adjusted Life Years
EPOC	Effective Practice and Organisation of Care
FAP	Familial Adenomatous Polyposis
FOBT	Faecal Occult Blood Test
gFOBT	Guaiac-based Faecal Occult Blood Test
GP	General Practitioner
HNPCC	Hereditary Nonpolyposis Colorectal Cancer
iFOBT	Immunochemical Faecal Occult Blood Test

ITS	Interrupted Time Series
LOTE	Language Other Than English
NBCSP	National Bowel Cancer Screening Program
NCSR	National Cancer Screening Register
NHMRC	National Health and Medical Research Council
NSW	New South Wales
OR	Odds Ratio
PCP	Primary Care Provider
RACGP	Royal Australian College of General Practitioners
RCT	Randomised Controlled Trial
UK	United Kingdom
USA	United States of America
UTN	Universal Trial Number
YLL	Years of Life Lost

ABSTRACT

Colorectal cancer (CRC) is an important health problem globally and nationally. In Australia, every week, over 300 people are diagnosed with CRC, and 80 will die from this disease. When CRC is detected and treated early, there are high survival rates. CRC is amenable to screening as it has a long latency period during which microscopic traces of blood can be detected using a simple test called a faecal occult blood test (FOBT). To support CRC screening, Australians are offered biennial FOBT through the National Bowel Cancer Screening Program (NBCSP). Despite the proven benefits and accessibility of CRC screening in Australia, only 41% of those invited to screen by the NBCSP return completed FOBTs. Data collected from Australian general-practice- and population-based community surveys also suggest CRC screening rates are low. However, the most recent data were collected in 2011. Additionally, not all research assessed whether screening was adherent to Australian CRC screening guidelines.

Examining correlates of CRC screening behaviour can illuminate which groups are least likely to adhere to screening guidelines. Those in younger age groups, i.e. 50-59 years, are consistently reported to have higher rates of under-screening compared to those in older age groups. However, other correlates of under-screening for CRC vary depending on the source of data. For example, the NBCSP reports higher rates of under-screening for males, a finding that is contrary to general-practice- and population-based community studies which have reported that females are more likely to be under-screened. Ascertaining correlates of under-screening from healthcare settings can contribute to the current body of evidence and may be used to design

targeted interventions to increase CRC screening in those least likely to adhere to guidelines.

General practitioner (GP) endorsement of CRC screening is a positive predictor of screening behaviour, and GPs have a recognised role in promoting preventive health activities, including CRC screening. GPs can be integrated into population-based programs, thus potentially having a positive effect on uptake of screening within the program.

This thesis by publication consists of an introduction, six papers, a discussion of the key findings, implications and future directions, a review of the strengths and limitations of the research, and conclusions. The data-based papers report data collected from healthcare settings. The studies reported in papers 1 to 3 report new cross-sectional data on CRC screening practices of individuals attending these settings, and include both under- and over-screening, as well as knowledge of CRC risk factors and screening recommendations. Paper 4 reports a review of trends in general-practice-based research into CRC screening prevalence, using descriptive or intervention methodology, over time. The studies reported in papers 5 and 6 describe the protocol and delivery of a general-practice-based randomised controlled trial which aims to increase CRC screening uptake.

The results of this thesis suggest that there is an evidence-practice gap for CRC screening adherence in those attending healthcare settings in Australia, with both under- and over-screening reported. Males and those in younger age groups were more likely to report under-screening. Levels of knowledge of CRC risk factors and screening recommendations were low; less than one-third knew the correct age to commence CRC screening, and 40% knew that FOBT was the recommended test. This suggests that strategies may be required to reinforce CRC screening recommendations among patients attending healthcare settings.

A review of the peer-reviewed literature reveals that a high proportion of research effort has consistently been directed toward the evaluation of interventions to increase CRC screening in general practice, using robust study designs. Despite this, under-screening in this setting remains an area requiring improvement, suggesting that future research should focus on effectiveness trials, to determine which interventions are likely to be adopted into routine practice. Finally, we found that an intervention involving GP endorsement, and provision of point-of-care FOBT and printed information significantly increased CRC screening uptake among general practice patients. There is potential for the role of GPs in promoting CRC screening to be better integrated into the NBCSP. Effective general-practice-based interventions could be incorporated into routine practice to boost CRC screening participation rates.

THESIS OVERVIEW

This thesis is comprised of an introduction, six papers and a discussion. All papers have been published in peer-reviewed journals.

The first section of the introduction describes the aetiology, risk factors, incidence, lifetime risk, burden of disease, diagnosis, treatment and survival rates for colorectal cancer (CRC). The second section of the introduction describes the current evidence underpinning CRC screening guidelines, and how these are reflected in the National Bowel Cancer Screening Program (NBCSP). CRC screening data from other sources, including general practice and community settings, are reported. This leads to a commentary on the current evidence for general-practice-based strategies to increase CRC screening. The introduction concludes with the overall objectives of the thesis.

The study reported in paper 1 is a descriptive cross-sectional study of 197 participants, recruited from outpatient clinics of a major regional hospital. The objectives of this study were to examine the proportion of those at average risk of CRC, aged 50-74, who report being under- or over-screened for CRC, and the characteristics associated with under-screening. We also sought to establish the willingness of participants to receive CRC screening advice and the acceptability of different methods of receiving help. Approximately 40% of participants were under-screened for CRC. Of those reporting colonoscopy in the past five years (n=48), 21% (n=10) were potentially over-screened (i.e. they were at average risk and had undertaken colonoscopy for the purpose of screening). Males were more likely to be under-screened than females. Of those

under-screened, less than half were willing to receive screening advice. The majority were most interested in information being mailed to their homes. Papers 1 and 3 reported CRC screening rates that were higher than those reported by the NBCSP. This is most likely due to differences in the denominators used to determine screening uptake in the current study and that used by NBCSP. For example, the NBCSP reports screening uptake for all those invited to screening, some of whom are ineligible for screening, while this study excluded those ineligible for FOBT screening. Further, our study was able to capture screening conducted outside the NBCSP. Finally, we found that mailed CRC screening information is an acceptable method to provide CRC screening advice.

Higher levels of knowledge related to CRC may be associated with positive CRC screening behaviour. The study reported in paper 2 describes participant knowledge of CRC risk factors and CRC screening recommendations among 363 participants, aged 18-85, from five general practices, and the sociodemographic characteristics associated with higher knowledge levels. CRC risk factors were presented as five yes/no options. One-quarter of participants correctly identified all CRC risk factors, while 10% identified none. CRC screening recommendations were presented as four multiple-choice questions. Less than 10% of participants identified all the correct responses. Just over half knew that FOBT was the recommended screening test for those at average risk, and a smaller percentage (41%) could identify the recommended frequency for FOBT testing. Those with a tertiary education were more likely to score highly in both areas. The results suggest that there are gaps in CRC risk factor and

screening knowledge. It may be important for future intervention studies which aim to improve screening uptake to address gaps in knowledge.

To further explore CRC screening behaviour, the study reported in paper 3 presents cross-sectional data from 179 participants from five general practices in New South Wales, Australia. This study examined the proportion of those at average risk of CRC, aged 50-75, who report being under- or over-screened for CRC, the characteristics associated with under-screening, and the source of reported FOBTs. One-third of participants reported being under-screened for CRC. Of those who were up-to-date with screening using FOBT, one-quarter (n=22) reported sourcing this from their GPs. Of those reporting colonoscopy in the previous five years (n=66), 29% (n=19) were potentially over-screened. As age increased, there was less likelihood of under-screening. The findings of this paper suggest, as did those of paper 1, that although under-screening for CRC remains a problem, rates of CRC screening were found to be higher than those reported by the NBCSP. This, again, may be due to differences in denominators and the ability to capture screening occurring outside the NBCSP.

Over time, research efforts should progress from identifying the size of evidence-practice gaps, to strategies to address these gaps. If this occurs, there would be an increase in the number of interventions relative to descriptive research in this area over time. Paper 4 is a critical review which examines the trends in research effort across three lots of three-year time points since 1993. Publications reporting primary

data on CRC screening prevalence in general practice using an observational study design, or reported interventions delivered in general practice where CRC screening was the primary outcome, were included, yielding a total of 102 publications. Of these, 65 reported intervention studies, and 37 reported observational studies. The proportion of each study type did not change significantly over time. The majority of intervention studies met Effective Practice and Organisation of Care (EPOC) design criteria at each time point. Despite a high proportion of intervention studies which used robust study designs, under-screening for CRC in general practice continues. This indicates that further research in general practice is needed to establish interventions that are most likely to be adopted into routine practice.

Papers 5 and 6 describe a protocol and the outcomes, respectively, of a randomised controlled trial (RCT) which is registered with the Australian New Zealand Clinical Trials Registry (ACTRN12616001299493). The objectives of paper 6 were to examine, among under-screened general practice patients at average risk of CRC aged 50-74, the effectiveness of provision of point-of-care FOBT, printed CRC screening advice and face-to-face GP endorsement on: a) self-reported FOBT uptake; and b) CRC screening knowledge. The study was a multisite, 1:1 parallel-arm, cluster RCT conducted in four general practices. The intervention significantly increased FOBT uptake in the intervention group. Those in the intervention group were almost eight times more likely to complete FOBT when compared to usual care (39 vs 6%; OR 10.24; 95%CI 2.9-36.6, $p=0.0006$). The findings of the study reported in paper 6

suggest that general practice interventions may be an important adjunct to the NBCSP to boost CRC screening rates.

The discussion draws together the key findings of the papers within the thesis. Each finding is followed by implications and future directions related to the reported finding. Finding 1 reports rates of under- and over-screening for CRC and recommends that additional strategies are required to identify and address both under- and over-screening. Finding 2 explores correlates of under-screening, and highlights the need for specific intervention strategies for sub-groups that are less likely to be adherent to screening guidelines. Finding 3 reports general-practice-based interventions to improve CRC screening, and includes the effect that a multicomponent general-practice-based intervention, including GP endorsement, point-of-care FOBT and a printed information sheet, has on FOBT uptake. Recommendations for future research, including enhancing current study design and conducting cost analysis, are discussed.

Following this is a review of the strengths and limitations of the papers included within the thesis. Strengths of this thesis include: an updated snapshot of CRC screening behaviour; use of current Australian guidelines to detect under-screening; ability to detect over-screening; and use of an RCT study design to test the intervention. Some limitations are acknowledged: use of convenience samples which may limit the generalisability of findings; a simplified method to determine CRC risk

that may have led to some inaccuracies in risk estimation; and use of self-reported screening data that may have led to reporting bias.

Finally, the discussion concludes by summarising the most important findings of each paper and the overall thesis.