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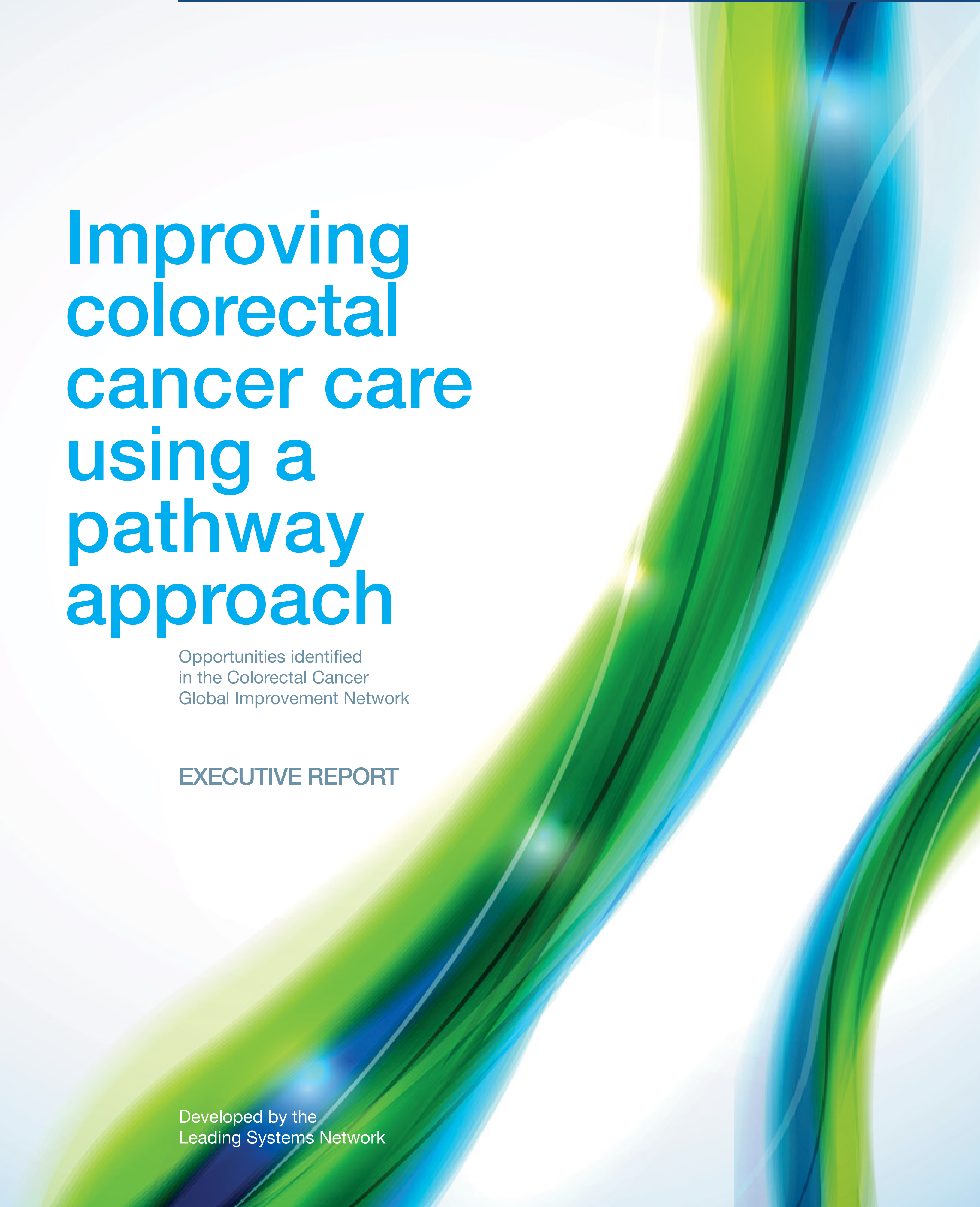

Improving colorectal cancer care using a pathway approach

Opportunities identified in the Colorectal Cancer Global Improvement Network

EXECUTIVE REPORT

Developed by the
Leading Systems Network

Foreword

As a colorectal surgeon and policy-maker, I welcome the publication of this report, which lays out an innovative agenda for system-level improvement in colorectal cancer care. I applaud the health systems whose collaboration made this report possible, and whose leaders are addressing a challenge incumbent on health systems worldwide—determining how we can close the gap between what we know and what we do in the provision of cancer care.

The systematic ‘pathway’ approach to improvement helps to broaden our thinking and prioritize our efforts as health system leaders. For clinician leaders who are trained, as I was, to focus on a narrow excellence in patient care, taking system-level accountability for outcomes and value in care can be challenging. However, these health systems and this effort have shown the utility of looking at the whole pathway and the potential to find important ‘value pools’ where system-level improvements can and should be made.

Considered in the context of important advancements in colorectal cancer care over the last three decades, we can see that much has been achieved, and much work remains to be done. One can see in this report how incorporating the perspectives of clinicians, managers, and pathway stakeholders can shed light on the true priority areas for improvement. The data shows us the importance of earlier detection and persistence of internal outcome variation, and calls us to take action to address these and other issues systematically.

Professor the Lord Darzi of Denham
PC KBE FRS FMedSci HonFREng
Paul Hamlyn Chair of Surgery, Imperial College London
Chair, Colorectal Cancer Global Improvement Network

5	Health systems collaborating to improve outcomes and limit cost along disease pathways
84	Steps in the colorectal cancer care pathway
3,700	Deaths from CRC each year across all five systems
250+	Lives each year could be saved through a combination of improvements
$50m	In savings opportunities identified (on a base of approximately $750m)

Executive summary

Based on the collective effort of 5 health systems in the Global Colorectal Cancer Improvement Network, this report lays out a global improvement agenda for colorectal cancer. The agenda addresses the large and growing challenge posed to the healthcare system by colorectal cancer, currently responsible for more cancer deaths than any other type except lung cancer.

The participating health systems used an international best practice care pathway to structure a holistic evaluation of pathway performance. The evaluation incorporated managerial, clinical, outcomes, and spending assessments to, for the first time, paint an end-to-end picture of how well systems deliver colorectal care for their populations.

Each health system appointed a project team composed of clinical and managerial leaders to conduct analyses and draw insights on the end-to-end pathway. Incorporating input from a wide range of pathway stakeholders, these teams identified their top priorities for improvement and are pursuing initiatives to capture the identified opportunities.

Common themes in colorectal cancer improvement emerged. Centered on but not limited to early detection, ten ‘value pools’ show where health system leaders should prioritize improvement efforts to make a significant impact on outcomes, cost, and/or patient experience. Several innovative health systems, including Kaiser Permanente in the US and Cancer Care Ontario in Canada, have begun to address these value pools, and their experiences have been documented here as well.

The effort illustrates the value of collaboration, both inside and outside a given health system. Inside the system, clinicians and managers across a patient pathway should convene and work toward a coherent set of goals. Outside, in the broader healthcare environment, payors, providers, and pharmaceutical companies can and should partner to identify areas of mutual benefit.

Colorectal cancer is only one disease of many that could be addressed using this approach. As the healthcare sector evolves toward greater accountability for population health, the pathway approach provides a valuable roadmap for improving outcomes and increasing the value of care provided.

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Introduction

Colorectal cancer (CRC) is a deadly and costly disease creating a considerable burden on health systems worldwide. Approximately ten percent of all cancers are colorectal cancers, making this site the third most common behind lung and breast.[1] CRC ranks as the seventh leading cause of death in high income countries and the twentieth leading cause worldwide.[2] Combating new cases of colorectal cancer costs health systems USD 32 billion yearly – second only to lung cancer in overall cancer spend.[3]

Further, the challenge of CRC to health systems becomes more significant each year. The global burden of disease is increasing, driven by demographic shifts (e.g. aging populations) and lifestyle shifts (e.g. toward unhealthy and processed diets) in countries around the world. By 2030, the World Health Organization projects CRC will jump to be the 14th leading cause of death.[4] Spend on CRC is, expectedly, increasing alongside. More incident cases, longer survival, and increasingly expensive treatments are projected to result in worldwide yearly spend of USD 47 billion by 2030.[3]

It is clear that some systems perform better than others in terms of CRC outcomes.

Examining this issue, a study by Colman et al on comparative outcomes among affluent OECD countries reveals significant variation in one of the most important indicators of care quality: five-year relative survival after diagnosis. For example, the United Kingdom at 53.6 percent compares poorly with Sweden at 62.6 and Australia at 65.9.[5]

International comparisons of spend are less clear, owing to the difficulty in capturing standardized estimates of the entire extent of expenditure on CRC. However, limited evidence does suggest that wide variations exist across countries, with France spending as much as six times more on care on a per death basis than Sweden.[6] A better understanding of this variation requires a closer examination of practice patterns and consideration of the comparative outcomes achieved for each system's investment.

5-year colorectal cancer relative survival

2005–07, ICBP published in The Lancet 2011

Stage at diagnosis is the chief determinant of CRC outcomes and spend for an individual patient. CRC is considered highly curable at early stages and likely fatal at late stages. To illustrate, a patient in England diagnosed with Stage I CRC currently has a greater than ninety percent chance of surviving five years, while the same patient diagnosed with Stage IV CRC has a less than ten percent chance.[7] Figures are similar across the developed world and have informed efforts by health systems to detect CRC as early as possible in its disease progression.

On the other hand, CRC care today cannot begin and end with early detection. Some CRC cases will continue to go undetected until the patient's initial presentation, often in emergency rooms with symptoms indicating significantly advanced disease and requiring expensive urgent intervention. Therefore, effective and efficient care in acute settings with robust follow-up must remain a focus of clinicians and managers concerned with performance in CRC services.

Against this backdrop, health system leaders face a daunting and multifaceted challenge, and at the same time remain hampered by barriers to improvement typical in health systems worldwide. Broadly speaking, these barriers can prevent an integrated understanding and effort to improve outcomes while limiting overall spend:

- Clinicians and managers may not collaborate frequently or establish common aims with respect to colorectal cancer "improvement" in terms of value—including both outcomes and cost

- Data remains isolated in disparate databases, making coordinated analysis difficult (e.g. cancer registries, acute care records, primary care records, screening program records)

- Stakeholders across the pathway—including those in public health, screening programs, primary care, and acute care—tend not to coordinate strategies toward improving care

- Service provision often overlaps among public and private payors, public and private providers, national and sub-national governments, and public health, acute care, and primary care settings

- Colorectal cancer remains an unfashionable disease, which has historically received less focus than other cancer types, and therefore community awareness is often low

Thus the question of health system improvement for colorectal cancer remains: How can a health system improve its services to get closer to international best practice and use finite resources more efficiently? The answer must be generated by a diverse group of stakeholders taking part in an accessible, transparent, meaningful exercise of identifying opportunities and prioritizing improvement activities.

Improving cancer care using the pathway approach

An evidence- and pathway-based improvement approach, beginning with public health and including primary and acute care interventions, can be used as a framework for health system leaders to understand performance and identify opportunities to impact the disease burden and cost of care.

The foundation for this improvement approach is a comprehensive evidence base on colorectal cancer care. Owing to substantial advances in research and practice over the last twenty years, scientific evidence points to a common set of population-level interventions that health systems should implement to ensure optimal outcomes. This objective evidence base can provide the basis to focus discussions between clinicians and health system managers on the highest-priority topics. Moreover, the evidence base can provide guidance for managers who may be unfamiliar with clinical aspects of CRC to properly evaluate divergence from established protocols and measure performance in terms of clinical outcomes.[i]

Clinicians must lead these efforts alongside health system managers. Their expertise and leadership are critical components of success in any improvement effort. However, clinicians are often divorced from conversations regarding improvement. In particular, they are unlikely to have engaged in discussions on structural components of the CRC service, such as strategy, incentives, and information flows. They may not be involved in cost control or performance management initiatives. Yet clinicians typically are concerned with the quality and efficiency of care and are valuable partners in improving the managerial aspects of service provision.

Health systems are also increasingly willing to source innovations in care provision from outside their own system, region, or even country. As systems worldwide face common pressures, responses that have been successful in limiting cost and improving quality of care internationally may provide helpful models for improvement efforts at home. Establishing a specific disease pathway anchored in an international evidence review provides a platform and rich material for cross-system discussion and collaboration.

Developing an international evidence base

The task of developing an appropriate evidence base involves three principal steps:

1. Identifying relevant international guidelines for colorectal cancer care and compiling a comprehensive list of interventions
2. Evaluating the available evidence for each intervention to characterize its clinical- and cost-effectiveness
3. Prioritizing the most effective interventions and organizing them into an end-to-end pathway

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[i] For more on McKinsey's approach to pathway improvement in health systems, see Cavlan, Olivia, et. al."Using care pathways to improve health systems" *Health International 2011: 11.*

EXHIBIT 1

Guidelines and other clinical resources used to compile international evidence base

Australia	NHMRC: National Health and Medical Research Council (2005)
Europe	EGCRC: European Guidelines for Quality Assurance in Colorectal Cancer Screening and Diagnosis (2011)
Scotland	SIGN: Scottish Intercollegiate Guidelines Network (2011)
United States	NCI: National Cancer Institute Colon Cancer (2012) NCI: National Cancer Institute Rectal Cancer (2012) NCCN: National Comprehensive Cancer Network USPSTF: US Preventative Services Task Force
United Kingdom	NICE: National Institute of Clinical Excellence (2011)

In order to build a robust understanding of the CRC pathway, the project team reviewed eight sets of clinical guidelines (see EXHIBIT 1) and 153 peer-reviewed academic articles cited by those guidelines. Based on this review, the CRC pathway was found to contain 84 specific interventions (see Appendix: All interventions in CRC pathway). The project team then evaluated these interventions to assess their clinical- and cost-effectiveness evidence and provide a ‘prioritization’ based on the synthesized results of this process. Thirty-four interventions were explicitly prioritized, signifying that health systems should focus resources on these proven interventions. Twenty-eight were explicitly deprioritized, signifying that health systems should not employ these interventions commonly, despite their inclusion in some or all clinical guidelines. The remaining 22 interventions could not be assessed to the same degree of confidence because of incomplete or conflicting evidence. This hierarchy of interventions provided an evidence-based heuristic for the broad-based effort of improving care along the CRC pathway.

Methodology of the Colorectal Cancer Global Improvement Network

Recognizing the potential for international clinical and managerial collaboration to drive both outcomes and cost improvement, five health systems undertook a collective improvement project organized and supported by the Leading Systems Network.

The project team representing each system was chaired by a senior clinical champion and coordinated by project managers and data analysts. In each system, a senior executive sponsor provided high-level guidance and oversight as well as a mandate for resourcing and data collection.

The goals of the project were threefold: first, to obtain a baseline understanding of outcomes and spend on colorectal cancer within each system through rigorous diagnostic exercises; second, to identify particular opportunities for improvement within colorectal cancer care; and third, to plan and resource at least one improvement initiative to capture this potential value in each system.

To achieve these goals, three phases of work proceeded over the course of twelve months: a diagnostic phase, an initiative design phase, and an implementation phase.

1. Diagnostic phase

In the diagnostic phase, systems undertook four diagnostic exercises designed to identify the challenges faced by clinicians and managers along their end-to-end colorectal cancer pathway.

- **Comparison of typical clinical practice to international best practice**. Clinicians used a survey tool to assess the frequency with which their system performed the prioritized interventions identified in the international evidence base. Their answers allowed for an evaluation of how closely typical practice meets international best practice along the CRC care pathway.

- **Assessment of organizational health and management practices**.[i] To address the research question “How well is the system set up to support care provision?” the LSN team used a survey tool to ask system stakeholders to evaluate their performance in managerial processes. Targeted interviews with senior system stakeholders were used for further investigation in particular issue areas.

- **Measurement of clinical outcomes**. System analysts undertook data collection for a selection of metrics sourced from the

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[i] Survey methodology based on “Management in Healthcare: Why good practice really matters.” Co-authored by McKinsey and Company and Centre for Economic Performance, London School of Economics and Political Science.

evidence base review that would quantify outcomes and care quality along the pathway. Data were age- and sex-standardized to improve comparability.

- **Aggregation of CRC-related costs**. Systems completed an analysis that enabled them to sum the overall expenditure on CRC by pathway stage and estimate hard-to-capture figures where appropriate.

For each of the diagnostic assessments, international comparisons were drawn between the five participating systems and with other available and comparable benchmarks. System leaders used these comparisons to evaluate potential system differences in working sessions. The diagnostic assessments were further supplemented by interviews with senior system leaders, workshops with clinicians and managers, and data analyses into particular topics of interest. Throughout the effort, the engagement of a variety of clinical and managerial stakeholders helped to provide context and feedback on the insights and conclusions, representing the entire patient journey (see EXHIBIT 2).

EXHIBIT 2

Key colorectal cancer pathway stakeholders

Anesthesiologists /anesthetists
Cancer registry managers
Cancer service managers
Colorectal surgeons
Endoscopists
Gastroenterologists Screening program administrators
General practitioners
Primary care physicians
MDT coordinators
Medical oncologists
Palliative care consultants / nurses
Pathologists
Patients and patient groups
Public health administrators / consultants
Specialist nurses / care coordinators
Radiation oncologists

2. Initiative design phase

The goal of the initiative design phase was to form an agenda for colorectal cancer care improvement and recommend specific initiatives that address a significant opportunity to improve outcomes, spending, or patient experience. This phase provided an opportunity for systems to interpret and contextualize the findings from the diagnostic phase and design interventions with a wide group of clinical stakeholders. Each system held a clinical workshop to share the diagnostic phase results and solicit feedback and recommendations to take forward.

The initiative design phase also provided an opportunity to facilitate the interaction of the Network participants and introduce perspectives from outside the five participating systems.

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i. Survey methodology based on "Management in Healthcare: Why good practice really matters." Co-authored by McKinsey and Company and Centre for Economic Performance, London School of Economics and Political Science.

3. Initiative implementation phase

The initiative implementation phase is an ongoing effort coordinated by the individual project teams. It is anticipated that this phase will last through May 2015, as systems undertake initiative resourcing and rollout.

Results from diagnostic phase

1. Typical practice survey

The typical practice survey showed that systems had largely aligned their local care pathway to international best practice with few exceptions. A small number of pathway steps were identified as misaligned with international best practice, including FOBT screening with guaiac technology, use of barium enema and flexible sigmoidoscopy as diagnostic modalities, and systematic use of colonoscopy as a screening and surveillance tool (see EXHIBIT 3).

On the whole, the exercise showed that colorectal cancer protocols of participating systems are well aligned to international standards. However this may not necessarily translate to practice, as care provided across a system may not always meet the standards laid out in national protocols. Given that the diagnostic was conducted as a survey of typical practice, it was not possible to fully assess the degree of variation in practice across the system, a theme explored later in the project.

2. Management practices survey

The management practices survey showed that systems experience significant difficulties in supporting end-to-end care provision. Across

EXHIBIT 3

Deviation from best practice pathway

Pathway steps	What does the evidence say?	What is happening in systems?	Path forward to re-evaluate practice
Guaiac faecal occult blood test (gFOBT) as a screening tool 〉	While gFOBT is clinically effective, (iFOBT) has been shown to be more sensitive, of the same specificity, and not significantly more expensive	Screening programs in some of the systems still use gFOBT	One of the systems is in the process of shifting from gFOBT to iFOBT screening
Screening colonoscopy 〉	Despite high sensitivity and specificity, colonoscopy should not be prioritized as a screening tool, due to much higher risk of major complications	Colonoscopy is still over-utilized as screening tool in some of the systems, albeit predominantly in the private sector	Systems are auditing overall colonoscopy demand to optimize endoscopy utilization
Flexible sigmoidoscopy as a diagnostic tool 〉	The use of flexible sigmoidoscopy as a diagnostic modality after positive FOBT screen is not prioritized due to lower detection rate than colonoscopy	Flexible sigmoidoscopy is still used at clinicians' discretion as a diagnostic modality to confirm positive FOBT	Systems are reviewing diagnostic pathways to reduce variation across physicians and improve adherence to best practice pathway
Risk adaptive follow up and colonoscopy use in surveillance 〉	There is a lack of evidence supporting the use of intensive colonoscopy in surveillance; risk-adaptive follow-up could help stratify the patient population and apply interventions effectively	Risk-adaptive surveillance protocols are not systematically applied, resulting instead in the frequent use of colonoscopy in follow-up	One of the systems is reviewing its surveillance protocols to ensure cost-effectiveness

all systems, 60 clinicians and managers were surveyed or interviewed on 27 dimensions of pathway management, including strategy, accountability, incentives, and data-sharing.

Overall, managerial practices for improving population CRC care are not well developed. Of the five systems, none have operationalized a CRC strategy linked to specific targets for improvement in terms of mortality or cost. There is limited accountability for population-level outcomes, and performance management is not conducted at the pathway level. In most cases, clinicians are working toward strong performance targets, though these are limited to their particular part of the pathway (e.g., post-operative mortality rates for surgeons).

The lack of 'pathway' visibility for outcomes that could inform strategies, accountability, and performance management belies the lack of integration of data systems among public health, primary care, and acute care. Many of the analyses that could have produced the most insightful results were impossible to conduct at the population level without significant manual effort and individual chart review. For example, viewing the referral routes for patients diagnosed with cancers could help systems understand how well screening programs are functioning and how well primary care pathways are facilitating referrals for investigation. Further along the pathway, having longitudinal tracking of cancer follow-up would enable comprehensive detection of recurrent cancers – a key indicator of surgical treatment quality. Unfortunately, 'tracing' a colorectal cancer patient journey and documenting each step involved in care, from screening to symptomatic presentation to treatment and follow up, remains impractical, and most health systems are not able to use these insights for strategic decision-making.

Management barriers

Confusion about strategy and goals

While there are overarching goals in place for improving outcomes, there is not a corresponding specific strategy explaining how the system aims to achieve these goals

Role confusion

Clinicians' relative roles and responsibilities in delivering care along the pathway according to protocols may not be clear, due to the lack of centralized direction

Care variation

While there is an appreciation for standardized clinical pathways, capacity constraints and individual clinician judgement create substantial variation in care delivery

Lack of pathway perspective

Many stakeholders lack a broad system-level understanding of the status-quo – how care is organized and managed in different parts of the pathway today

Limited accountability

Within each part of the pathway, protocols are well-established but accountability for enforcing these protocols is not assigned to an individual

Limited use of data

Data are not typically used to inform clinical decision making nor to drive improvements in adherence and outcomes beyond annual audits

EXHIBIT 4

Selected clinical outcome metrics

Metric	***Data collection***	***Results***
*Mortality rate**	5/5 systems	Average 13 per 100,000 population, lowest 9, highest 14
*Incidence rate**	5/5	Average 34 per 100,000 population, lowest 30, highest 38
Incidence by stage	5/5	Stage I detection range 12-18%, Stage IV 20-26%
Screening program participation	5/5	Lowest 20%, highest 56%, all below European 'desirable' guideline of 65%[8]
Emergency presentation rate	4/5	Between 19-23%, slightly below previously estimated figures for the UK at 25%[9]
Surgeries resulting in permanent stoma	4/5	Lowest 8%, highest 20%, all below 25% benchmark observed in UK Bowel Cancer Audit[10]
30-day post-surgical mortality rate	3/5	Average 1.5%, all below international benchmarks of 2.7-5.8%[11]
2-year observed survival by stage	3/5	Similar results observed with survival benefit for earlier detection; Significant variation observed in Stage IV survival at 2 years (21% vs. 25% vs 48% in Australia)
Screen-detection rate	3/5	Difficult for all systems to ascertain, estimates range from 5-15% vs. international best practice 33%[12]
Average length of stay for admissions for colorectal cancer	3/5	Median elective length of stay range from 7-11 days; median emergency length of stay from 10-19 days

** These metrics were adjusted to account for differences in age and sex composition of populations*

3. Clinical outcomes analysis

The objective of the clinical outcomes analysis was to understand how well health systems perform in terms of colorectal cancer care for their population, considered from a holistic perspective to provide insight along each stage of the pathway. Project teams attempted collection of 34 clinical outcome indicators, of which a subset of ten was prioritized for in-depth analysis (See EXHIBIT 4). These indicators were selected after a review of academic evidence, consultation with experts, and a discussion of feasibility with each participating system.

The clinical outcomes analysis led to three principal insights across all participating systems: (1) there is significant scope for improving outcomes in colorectal cancer (2) these improvement efforts should focus on early detection pathways, and (3) population-level datasets should be further developed to enable better performance management.

i. Improvement potential in colorectal cancer

Viewed in terms of incidence and mortality, the outcomes achieved for colorectal cancer are similar across the participating systems. However, when compared with international benchmarks, there is potential for improving outcomes in all systems (see EXHIBIT 5). In an optimally functioning health system, CRC incidence would decrease due to improved early detection and prevention efforts (i.e., adenoma removal), and survival would lengthen due to early detection and improved treatment. Overall, mortality would fall as a result of both lower incidence and longer survival.

ii. Early detection

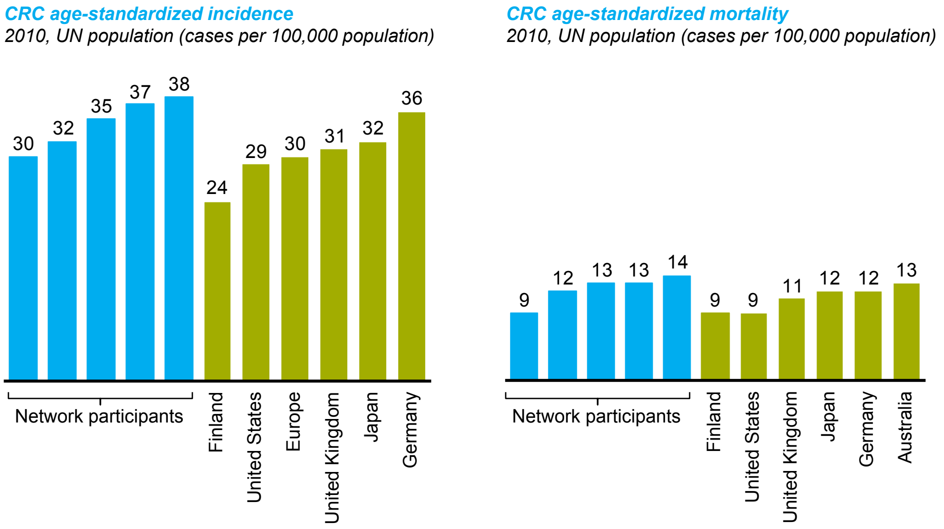
Early detection of colorectal cancer occurs through organized screening programs, opportunistic testing, or symptomatic presentation to primary care. When cases of cancer are detected earlier, the likelihood of cure is higher, and more cost-effective treatment options are available. As early stage disease is highly treatable, an optimally functioning health system that detected 100% of cases at Stage I would have almost 100% relative survival. The most effective way to achieve this goal is through screening, which picks up signs of cancer before symptoms are present. However, the reality of early detection across the participating systems was far from this ideal, with 45-55% of all cases diagnosed at Stages III or IV (see EXHIBIT 6).

Further, efforts to implement and increase screening have not been successful in increasing the percentage of screen-detected cancers (another important metric of early detection) beyond 15-20% of total cancer cases, as shown in one participating system (see EXHIBIT 7).

The opposite chart also shows a 23% emergency presentation rate, which has remained undiminished since 2007 when the screening program was introduced in this system. Stage for stage, cancers presenting as emergencies tend to have worse outcomes[13]

EXHIBIT 5

There is potential for improving outcomes in all systems



CRC age-standardized incidence
2010, UN population (cases per 100,000 population)

CRC age-standardized mortality
2010, UN population (cases per 100,000 population)

Source: CRC Improvement Network - preliminary submissions to clinical quality metrics diagnostic tool, Globocan (2008)

EXHIBIT 6

Early detection across systems is far from ideal

Percent of CRC cases in case cohort by stage (or unstaged), 2010

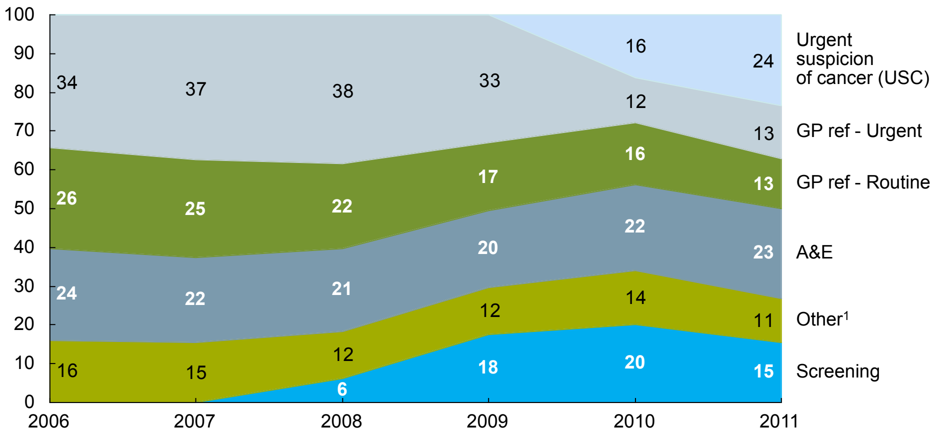
Cohort of cases for incidence by stage metric	1193	517	556[1]	1559[2]	760[3]
Total number of incident cases	1193	517	3566	1559[2]	2681
Incidence – ASR[4] Per 100,000 population	30.37	34.51	38.05	31.81	37.03
Incidence – ASR[5] Per 100,000 population	43.72	49.59	54.15	45.24	52.46

1 System A data derived from sampling of 556 patients within 3566 new cases | 2 System B data derived from average of 5 years data for incidence (2006-2010)
3 System C data derived from Colorectal Cancer in System C publication, limited to cohort of patients discussed at MDT meeting
4 Standardised using UN 2008 population | 5 Standardised using European Standard Population

EXHIBIT 7

Share of all diagnosed colorectal cancers by source of referral

Percent, 2006–11



1 'Other' pathway includes: Previous GP referral Subsequently Admitted to Hospital, Review Patient, Incidental Finding, Other, Source of Referral not Recorded

Source: SCAN audit data for Detect Cancer Early program and incur higher costs, especially when the presenting symptoms include bowel obstruction. This phenomenon in particular represents a failure of the pathway to prevent a universally sub-optimal set of outcomes: for patients, payors, providers, and pharmaceutical companies. Reducing the percentage of patients who present as emergencies and improving the screen-detection rate should be clear priorities for all stakeholders involved in colorectal cancer care and can provide a strong foundation for collaboration.

iii. Population-level data analysis

As discussed earlier in the results of the management practices survey, data availability and integration posed a significant challenge in understanding the performance of the pathway. In addition to the broad challenges of tracking patients through the system, targeted areas of the pathway remain largely opaque to system project teams as a result of poor data availability. These include quality data on chemotherapy usage, follow-up in primary care, and screening status of patients diagnosed with cancer.

4. Spending analysis

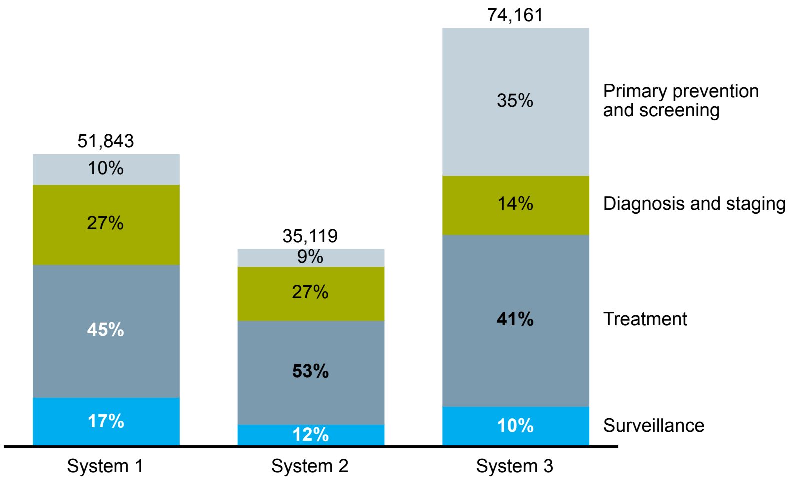
The objective of the spending analysis was to understand the total amount of spending on colorectal cancer care within each system. The exercise was completed from a payor perspective; thus the figures produced reflect the amounts of reimbursement transferred to providers rather than actual cost to the providers. Project teams estimated values for 35 separate drivers of CRC-related spending; three systems were able to complete the exercise to the degree required for comparison (See EXHIBIT 8).

The total spending analysis led to three principal insights across all participating systems: (1) there are significant differences

EXHIBIT 8

Estimated relative spend across pathway by incident case

Percent of total, USD



Source: CRC Improvement Network, Cost waterfall submission across health economies in the amount of spending per case of colorectal cancer (2) the distribution of spending across the pathway varies substantially (3) colonoscopy is a key driver of spending at the population level, especially if used on asymptomatic individuals for screening purposes.

i. Differences across health economies in per-case spending

The spending analysis represented the first time each system had attempted such an exercise at the population level. Prior estimates of per-case spending had been attempted at national level; however, these did not take into consideration the full cost to the health system of providing preventative, screening, and diagnostic services for patients who may not ultimately be diagnosed with CRC. Nevertheless, the existing health economics literature (with a partial, national pathway view) suggested that wide variations in spending could be expected, and this was confirmed through the spending analysis. The highest spending system spent more than double the lowest spending system per case (see EXHIBIT 8).

ii. Varying distribution of spending across the pathway

Using the evidence-based pathway as a framework, the spending analysis provided a segmentation of spending among the four pathway stages. The total amount of spending on each stage is seen properly in the context of total per-case spending, and this analysis provides insight into where systems are investing resources along the pathway compared to others. For each system, the treatment phase represented the largest portion of spending, between 41-53% of the total.

The greatest variation was seen in primary prevention and screening, where System 3 incurred 35% of its total CRC expenditure, whereas the others were 10% or less. In the case of System 3, high spending in primary prevention and screening was somewhat offset by lower spending in the diagnostic phase (14% for System 3 vs. 27% and 27%). Because the primary driver of early-stage spending in this system was colonoscopies used for screening, it is likely that fewer diagnostic colonoscopies were required. For the other two systems, higher spending in the diagnostic stage illustrated that referral pathways need to deliver better value so as to limit the resources needed to investigate suspected CRC during diagnosis.

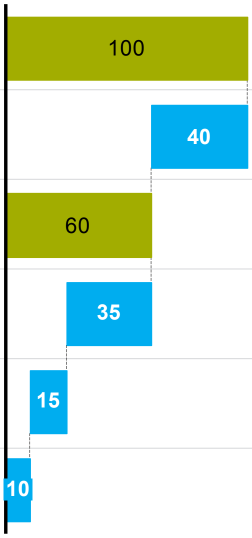
Surveillance spending was similar across systems and between 10-17% of total spend. System 1, with the highest share at 17%, identified an opportunity to standardize surveillance protocols to limit unnecessary spending in this area, especially in colonoscopy.

iii. Colonoscopy as a key driver of spending

As illustrated above, colonoscopy is a procedure with an important evidence-based role in multiple stages of the CRC pathway.[14] It is also a key cost driver owing to the high number of procedures performed relative to the total number of cancers detected. Across the participating systems, 15-45 colonoscopies were performed per case of colorectal cancer detected.

EXHIBIT 9

Analysis of endoscopy demand



	Est. share of all colonoscopies performed for different reasons *Percent of total number of colonoscopies*	**Total number of colonoscopies** *Number*	**Reason for investigation** *Not exhaustive*
All colonoscipies	100	169,154	▪ Colonoscopies ▪ With polypectomy
Non-CRC indications	40	67,622	▪ For suspected inflammatory bowel disease
CRC indications	60	101,492	▪ For suspected colorectal cancer
Screening	35	59,204	▪ For asymptomatic patients at – Average risk for colorectal cancer – High risk for colorectal cancer (e.g., genetic conditions)
Diagnosis	15	25,373	▪ For symptomatic patients referred from primary care ▪ For patients with a positive FOBT or flexible sigmoidoscopy (e.g., from screening)
Surveillance	10	16,915	▪ For follow-up for patients exiting treatment pathway

EXHIBIT 9 shows an exercise in estimation that one system performed to better understand its colonoscopy activity. Taking 100% of all colonoscopy activity (n= 169,154) readily available through payor activity data, the project team attempted to estimate the percentage of colonoscopies performed for non-CRC indications. For the remaining colonoscopies performed for CRC indications, they estimated the proportion done for screening, diagnosis, and surveillance. Screening colonoscopies were defined as procedures performed on asymptomatic patients and / or high-risk groups from family history or genetic conditions. For this system, it was found that screening colonoscopy was potentially being overused relative to other systems. Who receives colonoscopy, how often, and for what purpose remains a very important policy issue for systems to address in order to limit cost.

Recommendations for colorectal cancer pathway improvement

Based on the experience of the participating systems as well as consultation with experts from an additional five countries and health systems[i], we have identified ten 'value pools' in colorectal cancer care that could have the greatest impact on outcomes, spending, and patient experience (see EXHIBIT 10). We believe these value pools can serve as areas of priority focus for cancer strategies, outcome improvement efforts, and collaborations among stakeholders involved in colorectal cancer care and will apply to most health systems across the world. Together, they represent an opportunity to reduce total mortality and spending by 5-10%.[ii] Several real-world case studies are also included in the next section to demonstrate real-world examples of improvement.

EXHIBIT 10

Value pools in colorectal cancer

1. Improving screening uptake in targeted populations
2. Using screening modalities in concert and limiting their overuse
3. Refining referral protocols for symptomatic patients
4. Ensuring efficient use of existing endoscopy capacity
5. Using multidisciplinary teams informed by staging data to consistently coordinate acute care
6. Providing timely and effective emergency surgical care
7. Ensuring consistent provision of palliative care consultation
8. Enforcing standardized follow-up surveillance protocols
9. Reducing variation in access and outcomes across geographies
10. Tracking population-level outcomes through end to end data integration

1. Improving screening uptake in targeted populations

Certain segments of the eligible population for CRC screening have lower uptake, and there may also be more prevalent, undetected cancers concentrated in these groups as a result of lifestyle risk factors. These groups will vary for each system but are likely to include men, ethnic and linguistic minorities, the poor and deprived, and persons with limited contact with the healthcare system. Focusing investment toward improving uptake in these populations when conventional recruitment programs have not succeeded could improve screen-detection rates and stage at presentation while reducing inequalities currently associated with CRC screening. Along with other health promotion interventions, colorectal cancer screening should be promoted by primary care physicians to improve outcomes in these patient groups; successful techniques include in-person discussion and distribution of kits during primary care consultations as well as follow-up letters and phone calls.

2. Using screening modalities in concert and limiting their overuse

Screening using FOBT and FIT has proven to be cost-effective in academic literature, and many health systems have implemented such screening programs. Depending on economic factors, payors sometimes fund endoscopic screening procedures, which can bring added benefits from reducing

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[i] Experts from Belgium, Germany, Kaiser Permanente (US), the Netherlands, Norway.

[ii] Mortality benefits are derived from international comparison and expected value of reduction in internal variation (observed at +/- 5% across the Network). See Appendix for assumptions used to estimate potential savings in a hypothetical system of 1 million people.

incidence of cancer through removal of pre-cancerous lesions. Given that current evidence has not identified a clearly superior screening modality from an effective and/or efficient perspective, it is likely that a number of modalities including colonoscopy, flexible sigmoidoscopy, FOBT, and FIT will remain in practice. From a population health perspective, these should be considered and better-coordinated as part of an integrated cancer control protocol to ensure that all eligible patients are receiving appropriate screening. Systems should avoid over-testing using colonoscopy and performing serial testing using a variety of modalities, both of which can lead to very high pathway costs on a large asymptomatic population with no additional outcome benefit.

3. Refining referral protocols for symptomatic patients

When symptomatic patients present to primary care and CRC is suspected, the pathway to diagnosis remains inefficient and fragmented. Compared with breast cancer where ‘one stop’ diagnostic processes have dramatically streamlined this portion of the pathway, the colorectal cancer patient’s experience may still involve several steps with long waits due to inefficient referral protocols. In the absence of conclusive evidence on risk stratification for symptoms, primary care physicians appropriately refer many patients with possible cancer symptoms for investigation, making this a critical portion of the pathway for patient experience, including many patients who will not ultimately be diagnosed with cancer.

4. Ensuring efficient use of existing endoscopy capacity

It is important to note that colorectal cancer investigation is not the sole indication for colonoscopy, nor are endoscopy units responsible for only GI procedures. Endoscopy efficiency nevertheless remains a critical issue for CRC care improvement, given that colonoscopy remains the gold standard for colorectal cancer diagnosis. Discussions of endoscopy efficiency should also have a strong focus on cancer, given that diagnostic investigations account for 40-70% of all colonoscopies. Endoscopy units may be made more efficient through improved workforce allocation models (especially with regard to anesthesiology staff), administrative improvements (e.g. improved scheduling), or operational changes (e.g. reduction of turnaround time). Taken in combination, these improvements can free up endoscopy resources without adding additional fixed capacity.

5. Using multidisciplinary teams informed by staging data to consistently coordinate acute care

Under the prevailing model, when patients are diagnosed with colorectal cancer, their treatment planning will be discussed by a team including all relevant clinical stakeholders and coordinated by a nurse specialist. A critical consensus decision for treatment planning will be the diagnosed stage of the disease, as determined by clinical and pathological criteria. However, when clinical teams discuss treatment options, they may not come to a consensus on disease staging. Also, the difficulty in integrating all staging information can lead to mis-staging, which hampers efforts to track outcomes over time and perform risk-adaptive surveillance. In addition, there remains some risk that patients in rural or remote areas may not be discussed by a multidisciplinary team and will not have access to all potential treatment options or expertise. All colorectal cancer patients should be given an integrated stage by a multidisciplinary team.

6. Providing timely and effective emergency surgical care

Patients who present with obstructive cancers often require emergency surgery. These surgeries are often associated with the worst outcomes and should be performed by specialist colorectal surgeons, if possible. Moreover, Warwick et al have demonstrated that outcomes vary significantly across English hospitals for emergency admissions.[15] These admissions present a significant burden on hospitals, given the cost of unplanned surgery requiring fully staffed operating theaters, ICU beds, and further clinician management. Even so, a standardized pathway may not exist in all systems. Patients who can be stabilized until non-emergency surgery can be performed may have better surgical outcomes, a shorter length of stay, and incur less cost. Ensuring that specialist colorectal surgeons perform all operations may provide further benefit.

7. Ensuring consistent provision of palliative care consultation

For patients with terminal disease, access to palliative care consultation can considerably improve quality of life. Evidence-based provision of palliative care should be integrated throughout the care pathway to ensure palliation of symptoms. This is particularly important in end of life care, when clinicians often employ expensive chemotherapy with curative intent to extend life. In some cases, a palliative approach may be preferable to patients and caregivers, and can include palliative chemotherapy or other supportive care. Further, the place of death (in hospital, at home, or in hospice) may also represent an opportunity for improvement. A 2011 study in Ireland found that 49% of deaths from 1994-2004 occurred in hospital and suggested that unmet demand for hospice care exists.[16]

8. Enforcing standardized risk-adaptive follow-up surveillance protocols

The primary purpose of surveillance is to prevent and detect recurrent cancers. Although the evidence on specific protocols is not completely clear, systems should make some principled decisions. For example CT scanning and CEA testing form the recommended screening regimen, and colonoscopy is not recommended yearly. GPs or nurses, rather than specialists, can perform select follow-up visits—for example, when a more holistic consultation is required. At a minimum, the expected protocol of care should be standardized across a system with a defined dataset captured on all patients who have been treated.

9. Reducing variation in access and outcomes across geographies

Despite actions taken to establish clinical protocols, the distribution of services within most health systems remains uneven in colorectal cancer. Even in highly concentrated systems where acute care provision is housed in a single unit, the provision of early detection and follow up services in the community is often variable. In such situations, examining comparative outcomes in geographic subregions can help systems focus resources where they are needed most to reduce inequalities and improve access to critical services. Similar to the structure of the Global Improvement Network, a cohort-based approach, supported by a common evidence base and commitment to sharing best practices, can result in significant pathway improvement.

10. Tracking population-level outcomes through end to end data integration

It will remain impossible to understand improvement in colorectal cancer care without complete data on critical measures, such as stage at diagnosis and referral category to diagnosis. Integrating data sets is challenging for many health systems, but remains crucial in order to assess the performance of a health system across a pathway. The three most important datasets for colorectal cancer are screening program databases, multidisciplinary team (acute care) records, and cancer registries. If these are linked, many of the most insightful analyses (e.g., routes to diagnosis, recurrence rate) can be performed and used to improve care.

Improving colorectal cancer care and capturing value in these areas will require systems to think and work differently to ensure impact through service improvement. Specifically, improvement teams will need to overcome the aforementioned barriers that hamper many efforts to enact systemic change in health systems:

- Focus on cross-pathway collaboration on strategic priorities, which include clinical and managerial targets
- Align incentives to support behavior change and service realignment
- Improve data collection and availability across care settings
- Invest resources and attention on both screening and symptomatic early detection pathways
- Raise the public profile of the disease and reduce remaining stigma

Looking forward

1. Case studies

A number of health systems are pioneering innovative solutions for colorectal cancer care improvement, including:

- **Cancer Care Ontario**: In Canada, the Ontario health system has adopted incentives to encourage primary care physicians' participation in the provincial screening program. For example, doctors receive CAD 7 for FOBT kit distribution and counseling, an additional CAD 7 for follow up written notices and telephone calls. Across all of their eligible patient population, a bonus scheme applies which gives, for example, CAD 4,000 for attaining 70% uptake. The system centrally collects results for all screening modalities and tracks performance against the metric of share of population "current with screening using FOBT, flexible sigmoidoscopy, or colonoscopy."[17]
  ★*Impacting value pools 1 and 2 (see EXHIBIT 10)*

- **Kaiser Permanente**: In the United States, Kaiser Permanente Northern California (an integrated payor and provider health system) succeeded in increasing screening rates to greater than 80% from a baseline of 35% over eight years through a standardized approach to screening recruitment and follow up. Key components of the program included integration with data systems that could bring screening status to the attention of any attending physician as well as multiple mail, telephone, and electronic messages. Data integration from screening through staging and treatment helped to track the impact of these interventions, which included a reduction in absolute incidence and increase in screen-detection rate from 5% to 33%.[18]
  Impacting value pools 1, 2, and 10

- **NHS Improvement**: Faced with a predicted surge in endoscopy demand created by the rollout of the National Bowel Cancer Screening Program, NHS Improvement conducted a review of endoscopy services in the UK and created a six-step program for efficiency improvement to make the most of existing capacity. The modular recommendations include effective operational management, data collection and planning, understanding and managing demand, optimizing existing capacity, reviewing variation, and improving patient and public experience and engagement.[19]
  ★*Impacting value pools 3 and 4*

- **New York City Citywide Colon Cancer Control Coalition**: Stakeholders across New York City created the Coalition to improve screening rates across the city and reduce disparities in screening uptake. Programs have included peer education on colonoscopy preparation, Russian-language outreach to relevant communities, and payment incentives for colonoscopy quality aligned with national health reform efforts. Screening rates have increased from 42% to 69% citywide since 2003, and disparities among major ethnic and racial groups have been eliminated.[20]
  ★*Impacting value pools 1, 4 and 9*

- **Norway**: In Norway, standardized surveillance protocols for post-treatment follow up have been

in place since 1997. Operational and financial policies encouraging hospitals to assume greater responsibility for long-term outcomes in colorectal cancer further support these clinical protocols. According to a 2012 study by Søreide et al, 60% of Norwegian patients receive surveillance in accordance with national recommendations and 98% of patients received formally structured surveillance.[21] Cancer registries systematically track recurrent cancers, and a proposed pay-for-performance scheme is currently under debate to penalize hospitals for preventable recurrences.[22]
★*Impacting value pools 6, 8, and 10*

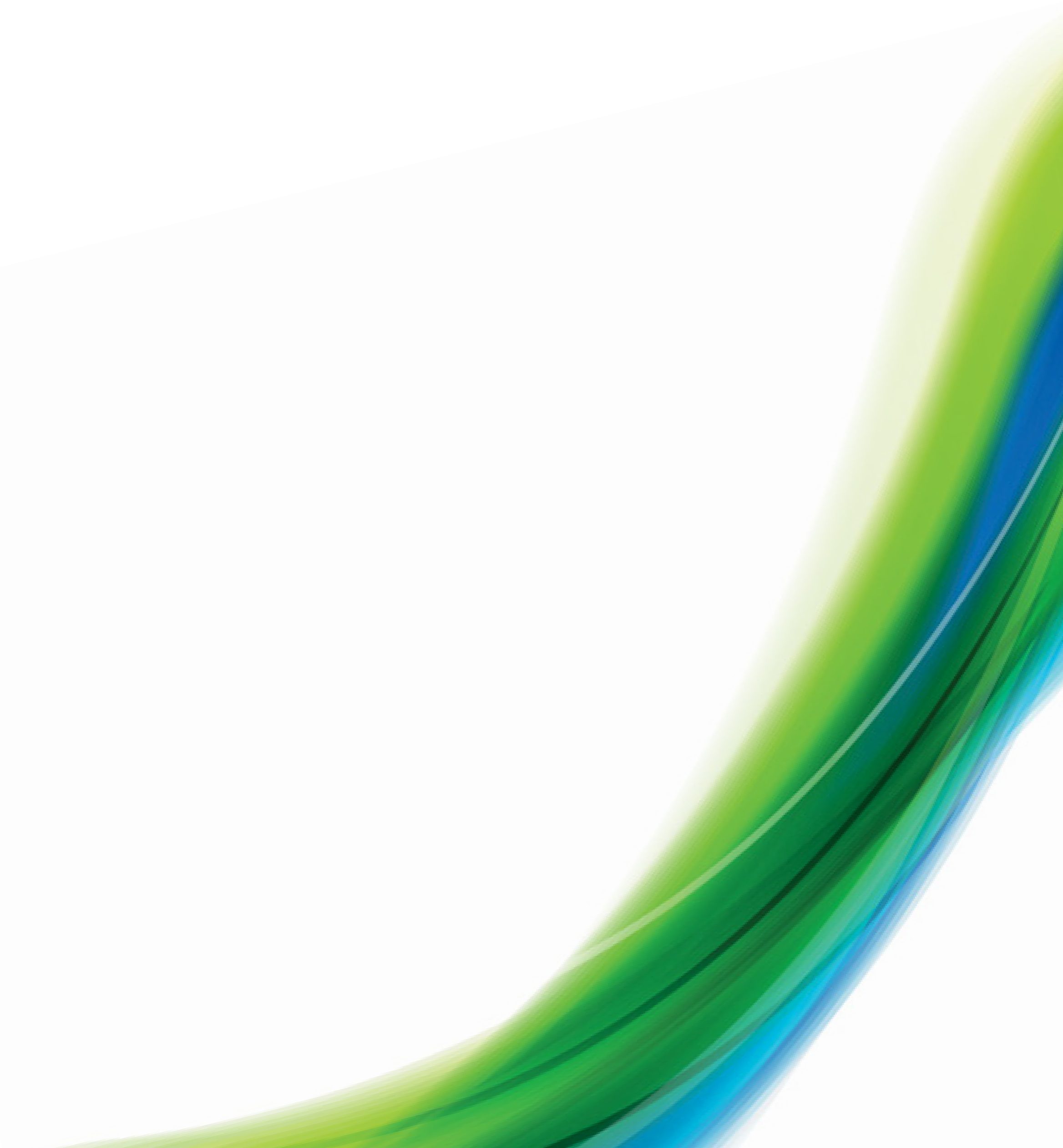
2. Future burden of disease

As health system budgets continue to shrink and demographic pressures mount, colorectal cancer will become increasingly important to address using an integrated, disease-specific approach. While it is a deadly and serious disease, it also presents an opportunity to limit spending and achieve substantial improvements in outcomes, perhaps uniquely among cancers given the existence of cost effective screening modalities and potential for curative treatment. The value pools described here can form the basis of an improvement agenda that helps high-income health systems onto a more sustainable path of resource allocation.

For upper-middle income health systems, which are only beginning to confront the colorectal cancer challenge, much work remains to be done, including improvements to treatment that occurred in most high income countries over the last twenty years. Fourty-eight percent of all colorectal cancers occur in middle income countries, and there are more cases each year in Russia than the UK.[3] The five countries with the highest CRC mortality rates today are Slovakia, Hungary, Czech Republic, Croatia, and Slovenia, and fourteen of the top twenty are in Eastern Europe.[4] The potential for improvement in these countries may be first found in more fundamental areas of access and quality, but at some point they too will need to pursue a similar value agenda as in high-income countries today.

3. Collaboration

The pursuit of excellence in colorectal cancer care should draw in a wide coalition of stakeholders, all of whom can benefit from improved value in the colorectal cancer pathway. As payment reform in many places in the world moves economic incentives away from individual procedures and more toward population level outcomes, collaboration is more important than ever. Decision-makers from all points in the healthcare delivery value chain have access to increasingly integrated datasets focused on the ultimate arbiter of healthcare quality – outcomes. The capabilities to interpret data, identify and recommend improvement opportunities, finance investments, and alter practice patterns are distributed among many actors today; yet in colorectal cancer, as in many other diseases, it is precisely this constellation of capabilities that will be necessary to achieve greater population-level value in cancer care.



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Appendix: All interventions in CRC pathway

Pathway stage 1: Primary prevention and screening

1	Regular physical exercise	Prioritized
2	Maintenance of healthy weight	Prioritized
3	Reduction of animal fat, red meat, and processed meat consumption	Prioritized
4	Reduction of alcohol consumption	Prioritized
5	Avoidance of tobacco use	Prioritized
6	High fiber diet	Prioritized
7	Limitation of energy intake	Deprioritized
8	Consumption of 5 or more fruit or vegetable servings per day	Deprioritized
9	Calcium supplementation for the prevention of CRC	Deprioritized
10	Calcium supplementation for the prevention of recurrent adenomas	Deprioritized
11	Use of 200 mcg/day selenium supplement	Deprioritized
12	Use of anti-oxidants and carotenoid supplement	Deprioritized
13	Use of daily 300mg of aspirin for a period of 5 years or more, for the prevention of CRC	Deprioritized
14	Use of low dose daily aspirin for the prevention of recurrent adenomas in patients where it is not contraindicated	Prioritized
15	NSAIDs for the prevention of CRC	Deprioritized
16	Hormone Replacement Therapy for the primary prevention of CRC	Deprioritized
17	Perform colonoscopic surveillance after polypectomy for pre-malignant adenoma	Prioritized
18	Guaiac fecal occult blood test (gFOBT) at least biennially among 60-64 year olds	Neutral
19	Immunochemical fecal occult blood test (iFOBT) at least bi-ennially among 60-64 year olds	Prioritized
20	Flexible sigmoidscopy once between 55 and 64	Neutral
21	Flexible sigmoidscopy and iFOBT combined	Deprioritized
22	Colonoscopy performed once at age 55	Deprioritized
23	CT colonoscopy (CTC)	Deprioritized
24	Stool DNA test	Deprioritized
25	Capsule endoscopy	Deprioritized
26	HNPCC – Microsatellite instability testing	Neutral
27	HNPCC – colonoscopy every 2 years starting at age 25	Prioritized
28	CRC in 2 first degree relatives, mean age <60 yrs: colonoscopy every 5 years starting at age 50	Neutral

Pathway stage 2: Diagnosis and staging

29	Referral for investigation of patients aged >40 who present with persistent or recurrent rectal bleeding or unexplained iron deficiency anaemia	Prioritized
30	Colonoscopy as a diagnostic tool, performed by trained gastroenterologists, leading to polypectomy	Prioritized
31	Flexible sigmoidoscopy and double contrast enema	Deprioritized
32	Colon capsule endoscopy	Deprioritized
33	CT colonography, if local radiology service is competent in this technique, as an alternative to colonoscopy or sigmoidoscopy and barium enema	Neutral
34	Chest, abdomen, pelvis (CAP) CT scanning for the local staging of colon and rectal cancer and detection of primary metastasis	Prioritized
35	MRI scanning with a pelvic or endorectal coil for staging of local rectal cancer, assessing T stage, CRM and nodal involvement	Prioritized
36	Endorectal ultrasound (EUS) for the detection of tumour depth for local resection for rectal cancer	Prioritized
37	Offer fluorodeoxyglucose positron emission tomography (FDG PET) for patients suspected of metastatic cancer, after CAP CT scan and discussion with MDT	Neutral

Pathway stage 3: Treatment

38	Undertake a multidisciplinary team approach (MDT) to management of patient care	Prioritized
39	Provide access to specialist palliative care advice and services to all patients, as appropriate to their symptomatic needs	Neutral
40	Initiate radical surgery where indicated for patients with localized cancer after polypectomy, with the consultation of an MDT	Prioritized
41	Omit mechanical bowel preparation in colonic surgery	Prioritized
42	Prescribe mechanical bowel preparation in elective rectal surgery	Prioritized
43	Prescribe antibiotic prophylaxis preoperatively	Prioritized
44	Prescribe thromboembolic prophylaxis preoperatively	Prioritized
45	Undertake laparoscopic surgery, performed by experienced surgeons, in patients where surgery is considered	Prioritized
46	Perform primary resection of an obstructing tumour, in emergency bowel obstruction, unless the patient is moribund (near death)	Neutral
47	Where facilities and expertise are available, perform left colonic stenting for the palliation of patients with obstructing colon cancer	Deprioritized
48	Perform minimally invasive surgery for stage I rectal cancer, for example local excision or Transanal Endoscopic Microsurgery (TEM)	Neutral
49	Perform low anterior resection (LAR) of a tumour with total mesorectal excision, when indicated	Prioritized
50	Perform elective rectal cancer surgery at centres with >20 procedures per year	Prioritized
51	Perform elective rectal cancer surgery with colorectal trained surgeons or by a surgeon who has previously undertaken >21 procedures	Prioritized
52	Prescribe adjuvant chemotherapy for high risk stage II colon cancer patients	Deprioritized
53	Use of 5Fluorouracil (5FU) + levamisole regime	Neutral
54	Use of 5Fluorouracil (5FU) + leucovorin regimens (LV)	Neutral
55	Use of oral capecitabine	Neutral
56	Use of 5FU/LV and oxaliplatin regimens	Prioritized
57	Use of XELOX regimen	Prioritized
58	Undertake preoperative radiotherapy for individuals with high risk localized rectal cancer as determined by MDT	Neutral
59	Use of preoperative chemoradiotherapy in the treatment of stage II &III rectal cancers	Prioritized
60	Use of capecitabine as a chemotherapy agent in preoperative chemoradiotherapy treatment	Deprioritized
61	Undertake post-operative radiotherapy, chemoradiotherapy or chemotherapy after local distal rectal surgical resection, where MDT deems it as appropriate e.g. in patients with tumour fragmentations and/or with lymphovenous involvement, or if preoperative radiotherapy is not done	Deprioritized
62	KRAS testing	Neutral
63	Oral capecitabine monotherapy for patients who cannot tolerate 5FU based therapy	Neutral
64	Raltitrexed for patients who cannot tolerate 5FU based therapy	Deprioritized

Pathway stage 3: Treatment (continued)

65	Tegufur uracil for patients who cannot tolerate oxaliplatin and iritotecan combination therapy	Neutral
66	FOLFOX therapy	Prioritized
67	FOLFIRI therapy	Prioritized
68	XELOX therapy	Prioritized
69	Addition of bevacizumab to oxaliplatin based therapy (FOLFOX or XELOX) as 1st line therapy[i]	Deprioritized
70	Addition of cetuximab to FOLFIRI as 1st line therapy	Deprioritized
71	Addition of cetuximab to oxaliplatin-based chemotherapy regimen as 1st line therapy	Deprioritized
72	Addition of panitumumab to FOLFOX as 1st line therapy	Neutral
73	Irinotecan monotherapy and best supportive care (BSC) as 2nd line therapy	Prioritized
74	FOLFIRI as 1st line therapy then FOLFOX as 2nd line therapy	Prioritized
75	FOLFOX with bevacizumab as 2nd line therapy	Deprioritized
76	Panitumumab with FOLFIRI as 2nd line therapy	Neutral
77	Panitumumab monotherapy after failure of chemotherapy	Deprioritized
78	Cetuximab monotherapy after failure of chemotherapy	Deprioritized
79	Pre-operative chemotherapy prior to resection of liver metastases	Neutral
80	Consider resection or ablation for liver and lung metastases	Prioritized

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i. For all biologics, including bevacizumab, cetuximab, and panitumumab, priority is highly dependent on cost effectiveness analysis and thresholds in specific markets; systems may wish to change prioritisation based on local circumstances.

Pathway stage 4: Surveillance

81	CEA testing and CT scanning as part of the intensive surveillance regimen, following curative resection	Prioritized
82	Colonoscopy surveillance after curative treatment	Deprioritized
83	Initiate an intensive follow-up regimen after curative treatment	Neutral
84	Perform risk adaptive follow-up in patients after curative treatment	Prioritized

Appendix: Estimation methodology used for value pool cost sizing

To create this model, we have used reasonable assumptions that could apply to a hypothetical developed world health system with 1 million inhabitants. Modifying these assumptions will result in a different end estimation of potential savings. This model is not intended to produce an exact figure of savings for every health system but rather an indication of what could be possible given the assumptions detailed below.

In such a hypothetical system, 550 incident cases of colorectal cancer would cause 200 deaths as a baseline. This corresponds to an incidence rate of 55 cases / 100,000 persons and a fatality rate of 36%.[ii] Two principal improvement opportunities can be sized: (1) endoscopy improvement and (2) shift of stage at presentation. These opportunities correspond to value pools 2, 4, and 8 for endoscopy and 1, 3, and 9 for early detection.

(1) At a rate of 30 endoscopy investigations per cancer found, 16,500 endoscopies would be performed.[ii] At an average cost of USD 1,000 per endoscopy, baseline endoscopy spending would be $16.5 million.[iii] Assuming a 5% reduction in the number of colonoscopies performed for screening or surveillance or repeat investigations for diagnostic purposes, $825,000 in savings is realized.[iv] A 5% efficiency improvement on the endoscopy procedure itself yields an additional $784,000 in savings on the now-smaller number of endoscopies.[v]

(2) Given a stage distribution of 20%, 30%, 25%, and 25% for Stages I, II, III, and IV respectively, there would be 110, 165, 138, and 138 cases for each of these stages. Achieving a stage shift through early detection efforts resulting in a distribution of 30%, 30%, 20%, and 20% would change the case distribution to 165, 165, 110, and 110.[vi] Using sample per-case treatment spending figures by stage from Ireland[vii], this shift represents a reduction in spending from $26.8 million to $25.4 million, a reduction of $1.4 million.

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i. These rates correspond to the average observed in the CRC Improvement Network and are in line with international benchmarks.

ii. This figure corresponds to the average observed in the CRC Improvement Network.

iii. The figure of USD 1000 reflects Australian figures of AUS 1100 for Medicare reimbursement and average US price of USD 1185.

iv. This assumption corresponds to the potential improvement represented by colonoscopy screening outside of guidelines (e.g., below 50) observed in one Network participant. The 5% figure may apply to various other situations (e.g., overscreening for surveillance colonoscopies, flexible sigmoidoscopy followed by colonoscopy).

v. This assumption corresponds to typical improvement opportunities observed in McKinsey clinical operations projects conducted in Europe. Potential levers for endoscopy efficiency improvement could include improved scheduling to reduce do not attend rates, alternative workforce models, or improved turnaround times.

vi. We believe a shift of this magnitude could be plausibly attained based on the experience of Kaiser Permanente, an integrated health system that has pursued strategic initiatives to improve screening uptake and succeeded in shifting stage at presentation by a similar magnitude to what is indicated here over a 5 year period. From 2005 to 2010 the percentage of screen-detected cancers increased from 5% to 33%. Localized cancer increased from 39% to 47% and metastatic cancer dropped from 21% to 15%.

vii. As documented in "The economic impact of colorectal cancer: what are the costs and where do they fall?" by Ó Céilleachair, et. al. presented at NCIN Cancer Outcomes Conference 2012. Analysis included costs of diagnosis, treatment, and follow up care for Irish colorectal cancer patients. We have used Irish figures in this analysis as a representative case in line with the figures seen in the CRC Improvement Network. Estimated spending in Ireland was EUR 39,607 or ~USD 52,000. For health economies with lower spending (e.g., UK) or higher spending (e.g., Australia, US) the potential absolute impact of savings estimates should be considered accordingly.

Together, these savings figures represent $2.9 million or 6.9% of total spending of $43.3 million.

Further improvement may be possible, though less likely, in two areas. First, incidence may be reduced by improved screening when colonoscopy or flexible sigmoidoscopy is used to remove polyps. If a 2% reduction is achieved (preventing 11 cases), an additional ~$570,000 in savings is realized. Second, if emergency surgery is performed by experienced surgeons with fewer complications realized and average length of in-hospital stay can be reduced by one day for the 68 cases which present as emergencies, an additional ~$70,000 could be added. Together, these ‘stretch’ opportunities bring total savings to $3.6 million or 8.3% of total.

We have given figures for a 5-10% improvement based on the above assumptions. The increased range reflects the potential for execution risk diminishing the potential savings or additional opportunities not specifically sized here (e.g., palliative care, surveillance consultations with physicians) increasing the potential savings.

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