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A Digital Population Tracking System Helps Improve Colorectal Cancer Survivorship Services

There are 17 million cancer survivors in the United States and 1.5 million estimated survivors of colorectal cancer.[1] As the number of colorectal cancer survivors continues to increase, there is a growing imperative for cancer programs and practices to implement sustainable survivorship models to address survivors' unmet needs.[2,3] A general framework around survivorship care has been defined, including a proposed survivorship model specific to survivors of colorectal cancer that calls for integrated delivery networks to implement a survivorship care model in a real-world setting.[4-8] Kaiser Permanente Northern California (Kaiser Permanente), an integrated health system serving 4.5 million patients across 21 cancer centers and more than 250 outpatient facilities, has previously reported on its colorectal cancer prevention efforts and the associated reduction in five-year colorectal cancer mortality, without racial or ethnic disparities in survival.[9-11] As of 2019, Kaiser Permanente had an estimated 250,000 cancer survivors, jointly managed by advanced practice providers (APPs) and oncologists—with transition to primary care for long-term survivorship care—within a single shared electronic health record (EHR).

To ensure proper follow-up care and surveillance for survivors of colorectal cancer, we developed a novel computerized survivorship surveillance program called the Permanente Medical Group Precision Tracking System. The tracking system was developed in 2017 to operationalize a consensus-driven,

> Software systems that electronically track patients with cancer and the use of quality metrics and measures to encourage best practices is the foundation for evidence-based survivorship care programs.[9]

evidence-based approach to post-treatment surveillance. In this article, we describe the key elements of the system (Table 1, page 20) and discuss its impact on survivorship care recommendations. The applicability of this computerized population-based monitoring program to survivorship care in other settings, using EHR and commercially available software, is especially broad as our Kaiser Permanente cancer centers represent a wide spectrum of practices across Northern California, ranging from urban settings to remote and rural areas that are socio-economically and ethnically diverse. Software systems that electronically track patients with cancer and the use of quality metrics and measures to encourage best practices is the foundation for evidence-based survivorship care programs.[9]

Table 1. Key Elements in Establishing Population Management for Colorectal Cancer Survivorship

Precision Tracking	Solutions Developed
Data elements	Cancer staging End-of-treatment date
Data systems	Translate established consensus care to standard operating protocol (see Figure 2) Use existing data solutions, like Microsoft Excel and Tableau (see Figure 3) Create dashboard metrics
Communication with clinical teams	Utilization of EHR "problem list"

EHR = electronic health record.

Identifying the Patient Population and Developing Protocols

As the first step for creating a population-level tracking system for survivorship care, we developed a methodology to identify Stage I through Stage III survivors of colon cancer, aged 18 to 85, through our EHR. Real-time, automated identification of these patients required two critical data elements: 1) cancer staging information and 2) the date active treatment ends. To achieve EHR integration, we asked our providers to input staging data into the colon cancer specific section of the EHR "problem list" (Figure 1, page 21). Next, we created a dedicated location in the problem list to document the end-of-treatment date (Figure 1). To improve staging compliance, over time we are incorporating a "hard stop" in the EHR that would prevent completion of charting if staging data has not been entered.

After finalizing agreements across all Kaiser Permanente cancer centers, we developed surveillance tracking protocols for carcinoembryonic antigen (CEA) testing and computed tomography (CT) scans (Figure 2, page 22). These agreements were forged by subspecialty-driven consensus based on NCCN Guidelines® recommendations, literature review, and national and international practice models for frequency and duration of follow-up with the goal of delivering value-based care while optimizing early recurrence detection.[12-19]

Leveraging Our Data Systems

To reduce delays and costs related to technology integration with the existing EHR for data collection, we created data dashboards to monitor our progress using Tableau (Figure 3a, page 23) and Microsoft Excel (Figure 3b, page 23). Patients are identified based on colorectal *International Classification of Diseases*, 10th Revision (ICD-10) codes in the problem list. Colon cancer survivors are automatically identified and surveillance tracking is initiated when the treating provider completes the end-of-treatment date as part of the survivorship care plan and staging tool documentation. Nurse coordinators then utilize the Tableau report and Excel "action lists" to identify patients for targeted chart review, document survivorship tracking enrollment in the EHR, and place standing orders for serum CEA testing and CT scans using pre-approved order sets. The Microsoft Excel "action lists" and Tableau reports are updated daily.

Developing and Staffing Our Tracking System

To staff the precision tracking system program, we recruited a dedicated team of registered nurse project coordinators, a master's prepared registered nurse manager, and a physician medical director—all with experience in population management. Each project coordinator manages approximately 1,500 patients. Project coordinators are tasked with placing orders and referrals for CEA levels and CT scans, as described above. Prior to outreach, the coordinators perform a targeted chart review to look for clinical changes or if new preferences for surveillance are declared. Co-ordinators send patients a secure message or letter depending on patients' access to the online Kaiser Permanente platform—a web- and app-based patient engagement portal that allows patients to review their medical information and interact with their healthcare team through the EHR. A cycle of outreach (defined as three outreach attempts, two weeks apart) is completed if a patient continues to be due for surveillance. After the last attempt, the coordinator contacts the treating provider to inform them the outreach cycle is completed and a six-month hold is placed in the system. After an additional six months, coordinators conduct a new targeted chart review and the cycle of outreach begins again.

Disenrollment from the surveillance tracking system is based on chart review and preferences communicated by patients or primary care providers. Providers can also order additional CT scans or CEA testing separately if they prefer surveillance studies to occur sooner.

All precision tracking functions are managed centrally, negating the need to develop these surveillance systems at each individual cancer center or clinic site.

We created dashboard metrics to monitor tracking efforts, and we have seen a demonstrated increase in recommended care as a result of this system, which has now enrolled more than 1,600 colorectal cancer survivors. For example, prior to the start of the Kaiser Permanente Precision Tracking System program, baseline estimates of adherence with CT and CEA surveillance of patients with Stage II through Stage III colorectal cancer between 2011 to 2014 were 48 percent and 81 percent, respectively. (We defined adherence as test completion between 6 to 18 months post-diagnosis.) From August 2018 to July 2019, after implementation of the precision tracking system, adherence with CT and CEA surveillance improved to a median monthly rate of 92 percent and 90 percent, respectively.

Figure 1. Example of "Problem List" Documentation for Precision Tracking*

*"Case/Care Management, Cancer Survivorship" problem list allows documentation of hyperlinked survivorship follow-up plan, with accountability for patient and provider preferences. "Colorectal Cancer" problem list code contains staging information. "Cancer History" documentation includes a section for end-of-treatment date, and "Oncology Treatment Summary" contains the survivorship care plan.

In addition to CEA testing and CT scans, we found an existing population management system for colonoscopy surveillance integral to the Permanente Medical Group Precision Tracking System (Figure 2). Our gastroenterologists determine colonoscopy surveillance intervals for patients with Stage I to Stage III colorectal cancer and enter them into the Patient Reminder, Outreach Management & Population Tracker (PROMPT) system, which assists with population health management and coordinates all population-level preventive activities for Kaiser Permanente.

The Permanente Medical Group developed PROMPT as a custom-build add-on to its EHR for accurate tracking of cancer screening and other disease prevention measures for all patients, regardless of their cancer history. Each month, PROMPT notifies Kaiser Permanente Gastroenterology Departments of patients with Stage I through Stage III colorectal cancer due for colonoscopy surveillance. Gastroenterologists review each patient for surveillance eligibility and then medical assistants perform active outreach. A population health management team led by a part-time clinical leader (gastroenterologist) oversees the PROMPT colonoscopy surveillance tracking program. Providers can deactivate PROMPT reminders in the system if a patient is not clinically appropriate for screening outreach.

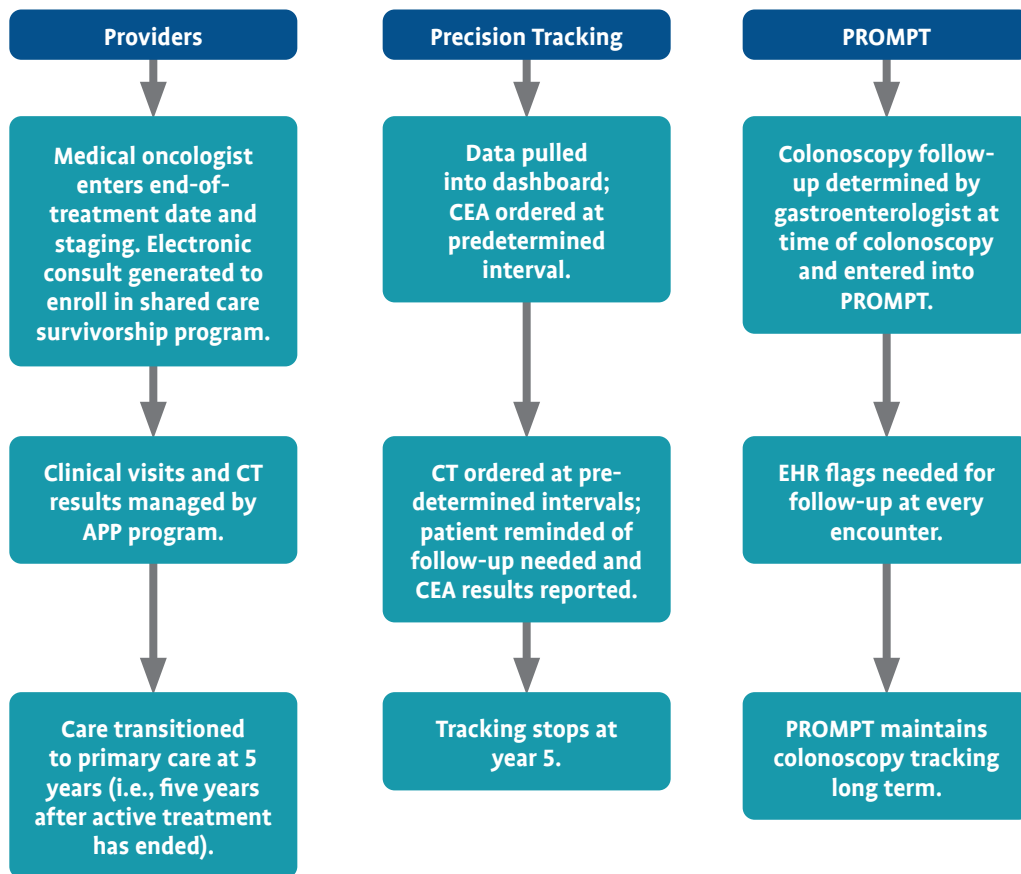### Improving Patient and Cross Disciplinary Provider Communication

To facilitate communication, CEA testing results are directed to coordinators who communicate normal results to patients via a secure message on the Kaiser Permanente portal or a letter. All CT results and abnormal CEA results are routed to the electronic

> The Permanente Medical Group Precision Tracking System program addresses key performance indicators proposed for high-quality survivorship care, such as disease surveillance and professional communication, and may also contribute to other aspects of oncology survivorship care.[23]

in-baskets of the treating providers, who then communicate directly with patients.

To communicate across disciplines, we created a unique entry under the EHR "problem list" for survivorship: Case/care management cancer survivorship (ICD 10 = Z71.89). The "problem list" contains pertinent active patient health issues and was adopted by Kaiser Permanente as a clinical management tool for care communication. With this newly created "problem list" code, all care team members, including primary care providers, can access and update dedicated information about the population management program and shared survivorship care model (Figure 1). The recently enacted 21st Century Cures Act requires healthcare providers to offer patients access to their health information

Figure 2. Parallel Pathway of Precision Tracking and PROMPT Systems to Support Provider Teams

Providers	Precision Tracking	PROMPT
Medical oncologist enters end-of-treatment date and staging. Electronic consult generated to enroll in shared care survivorship program.	Data pulled into dashboard; CEA ordered at predetermined interval.	Colonoscopy follow-up determined by gastroenterologist at time of colonoscopy and entered into PROMPT.
Clinical visits and CT results managed by APP program.	CT ordered at pre-determined intervals; patient reminded of follow-up needed and CEA results reported.	EHR flags needed for follow-up at every encounter.
Care transitioned to primary care at 5 years (i.e., five years after active treatment has ended).	Tracking stops at year 5.	PROMPT maintains colonoscopy tracking long term.

APP = advanced practice provider; CT = computed tomography; CEA = carcinoembryonic antigen; EHR = electronic health record; PROMPT = Patient Reminder, Outreach Management & Population Tracker.

in their EHR.[20] This includes making imaging results and clinic notes available on the Kaiser Permanente portal, where patients can access their survivorship documentation directly. Though our oncology providers still use survivorship care plans to communicate survivorship recommendations to patients, our primary care physicians have expressed preference for the "problem list" as the main communication method of survivorship care in the EHR.

Discussion
To our knowledge, this is the first software-based system developed by a large integrated health network to actively track and manage a population of colorectal cancer survivors. The approach incorporates proposed systems engineering models in cancer survivorship care by looking broadly at the work system, processes, and outcomes of a survivorship program.[21] It also addresses the call for novel approaches to colorectal cancer survivorship in integrated care systems by leveraging technology tools to manage tasks, such as CEA and CT monitoring, at the population level, and it
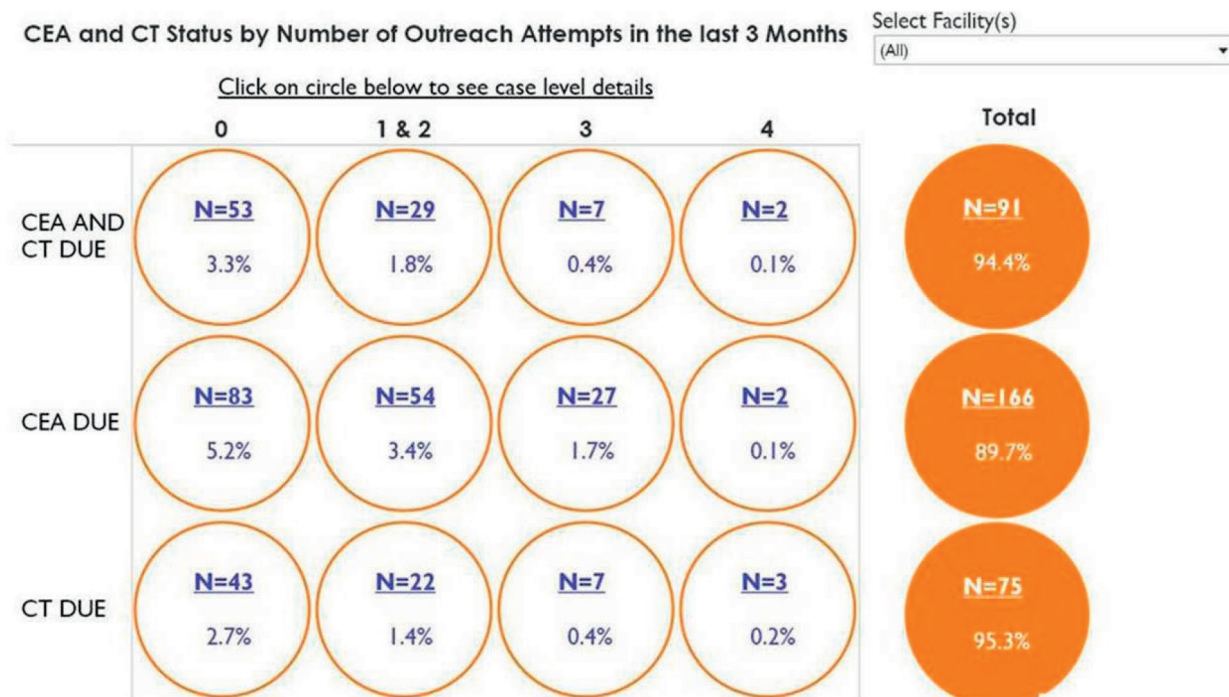
fills a significant gap in knowledge about available models of cancer survivorship that facilitate care beyond in-person visits.[8,22]

Data tools, such as Microsoft Excel and Tableau, are adaptable to other models of oncology care, and the model relies on well-known structural elements (e.g., "problem lists") which are found in all major EHRs.

The Permanente Medical Group Precision Tracking System program addresses key performance indicators proposed for high-quality survivorship care, such as disease surveillance and professional communication, and may also contribute to other aspects of oncology survivorship care.[23]

As a result of our standardization of best practices, we have heard anecdotally from members of the survivorship care team that recommendations for surveillance, communication, and care coordination have improved. There is also more time for providers to focus on other aspects of survivorship care, including symptom management, psychosocial support, health promotion, and chronic disease management.

Figure 3a. Tableau Report*

CEA and CT Status by Number of Outreach Attempts in the last 3 Months

Select Facility(s)
(All) ▼

Click on circle below to see case level details

	0	1 & 2	3	4	Total
CEA AND CT DUE	N=53 3.3%	N=29 1.8%	N=7 0.4%	N=2 0.1%	N=91 94.4%
CEA DUE	N=83 5.2%	N=54 3.4%	N=27 1.7%	N=2 0.1%	N=166 89.7%
CT DUE	N=43 2.7%	N=22 1.4%	N=7 0.4%	N=3 0.2%	N=75 95.3%

*Rows represent the number of patients who are due for outreach. Columns represent the number of outreaches that have been already attempted. Percentages in open circles represent the percentage of patients who are due for outreach.

Figure 3b. Excel "Action List"

RN comments	Facility	Patient_Name	Patient_MRN	hereditary	age	final_stage	end_of_treat_date	on_KPorg	Last_CT	next_appt
scheduled 1/1/2021	xxx	Smith, John	xxx	No	60	3	1/1/2020	Y	4/1/2020	1/4/2021

Action lists are reviewed to determine specific patients for targeted chart review and outreach, and these lists contain clinical information that can help with tracking.

With success around care adherence measures and positive feedback from provider teams, Kaiser Permanente has expanded the implementation of population management in survivorship care to other cancers, such as breast cancer, testicular cancer, non-small cell lung cancer, head and neck cancer, and melanoma. Furthermore, our providers are actively using the "problem list" to capture treatment exposures, long-term risks, and late effects, as well as other factors affecting survivorship care, such as ileostomy care. We are actively investigating the integration of patient reported outcomes measures into our dashboards.

For most healthcare settings, one of the biggest challenges in implementing a population management program for cancer survivorship is reimbursement. In developing its population tracking systems, Kaiser Permanente—a fully integrated health system—was not encumbered by prior authorization barriers. Under our integrated model, providers are salaried and work together across disciplines, departments, and hospitals; their compensation is not driven by relative value units, and metrics of success are focused on improving prevention, screening, and adherence to quality guidelines. Because Medicare reimbursement is tied to medical complexity, as evidenced in the active "problem list," utilization of survivorship "problem list" codes in visit documentation has the potential to support population management approaches to survivorship care under Medicare.

Kaiser Permanent has developed a novel colorectal cancer survivorship population tracking system and program that reflects its integrated approach to cancer prevention and preventative health. The formula of building technology systems to sustain and track care adherence and allowing providers to concentrate on high-value patient interaction, rather than increasing "desktop medicine" tasks, is crucial to improving care in cancer surveillance and beyond. Support for further research and reimbursement for

survivorship care will help ensure that we address the growing needs of survivors. These same tools can serve as the foundation for studies of surveillance approaches, including different surveillance intervals and novel approaches to early recurrence detection. ◼I

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