Colorectal Cancer Incidence by Age Among Patients Undergoing Surveillance Colonoscopy

A recent study from the Kaiser Permanente-Southern California region reported that, among patients undergoing surveillance colonoscopy, the rate of subsequent colorectal cancer (CRC) diagnosis was significantly lower for those aged 75 years or older than for those aged 50 to 74 years. The CRC incidence was 0.24 per 1000 person-years in older patients vs 3.64 per 1000 person-years in younger patients; in a multivariable proportional hazards model, the hazard ratio for CRC in elderly patients was 0.06 (95% CI, 0.02-0.13). The finding of a 15-fold lower CRC rate among older patients is striking considering that the CRC incidence is higher among those 75 years or older than those 50 to 74 years, according to the Surveillance, Epidemiology, and End Results Program database. We attempted to replicate this finding in the ancillary Study of Colonoscopy Utilization (SCU), a study examining the use and yield of surveillance colonoscopy, from the Prostate, Lung, Colorectal, and Ovarian (PLCO) cancer screening trial.

Methods | The PLCO was a randomized trial of prostate, lung, colorectal, and ovarian cancer screening. Approximately 155,000 patients aged 55 to 74 years were randomized at 10 screening centers between 1993 and 2001 to an intervention or control arm. For colorectal cancer, those in the intervention arm received flexible sigmoidoscopy (FSG) at baseline and year 3 or 5. In 2006, the SCU was conducted in patients who had abnormal results on a baseline FSG followed by diagnostic colonoscopy, with eligible patients randomly sampled at different frequencies based on baseline adenoma status (patients with advanced adenoma were oversampled; those with CRC were excluded). Patients participating in the SCU were queried by telephone about surveillance colonoscopies. Colonoscopy reports and pathologic findings were verified with medical records. Cancer incidence was ascertained in all PLCO participants, primarily through annual study updates. Study participants were observed for up to 13 years from randomization.

We defined surveillance colonoscopy as any colonoscopy occurring within 10 years of the diagnostic colonoscopy that followed the abnormal results from the baseline FSG; we excluded colonoscopies performed for symptoms or as follow-up to abnormal results on the FSG screening at year 3 or 5. The rates of incident CRC diagnosed at or after the first sur-

outpatient studies, patients answered more positively to empowerment questions after being given EHR access. Despite supporting patient empowerment, the promise of patients finding errors in their medications or knowing when they were being discharged never materialized. This study is, to our knowledge, the first published evaluation of the experience of a large sample of inpatients and their frontline health care practitioners with real-time inpatient EHR access, although it involved patients and practitioners on a single hospital unit. Federal programs recommend that patients be able to access results from their hospitalization within 36 hours of discharge. Based on our results, we believe that this requirement still misses an opportunity for patient engagement through better transparency, and future policies should consider real-time EHR access for inpatients.

Jonathan Michael Pell, MD
Mary Mancuso, MA
Shelly Limon, BSN, MS, CNRN
Kathy Oman, RN, PhD
Chen-Tan Lin, MD

Author Affiliations: Division of General Internal Medicine, Department of Internal Medicine, University of Colorado School of Medicine, Aurora (Pell, Lim); Professional Resources, University of Colorado Hospital, Aurora (Mancuso); Neuroscience Unit, University of Colorado Hospital, Aurora (Limon); College of Nursing, University of Colorado Denver, Aurora (Oman); Division of General Internal Medicine, Department of Internal Medicine, University of Colorado Health, Aurora (Lin).

Corresponding Author: Jonathan Michael Pell, MD, Division of General Internal Medicine, Department of Internal Medicine, University of Colorado School of Medicine, 12401 E 17th Ave, Mail Stop F782, Aurora, CO 80045 (jonathan.pell@ucdenver.edu).

Published Online: March 9, 2015. doi:10.1001/jamainternmed.2015.121.

Author Contributions: Dr Pell had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Pell, Limon, Lin. Acquisition, analysis, or interpretation of data: Pell, Mancuso, Oman, Lin. Drafting of the manuscript: Pell, Mancuso, Oman, Lim. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: Pell, Mancuso, Oman, Lim. Obtained funding: Pell. Administrative, technical, or material support: Pell, Mancuso, Lim. Study supervision: Pell, Lin.

Conflict of Interest Disclosures: None reported.

Funding/Support: This study was supported by the University of Colorado Hospital Clinical Effectiveness and Patient Safety Small Grants Program.

Role of the Funder/Sponsor: The funding source had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Additional Contributions: Esther Langmack, MD, CCMEP, Division of Pulmonary Sciences and Critical Care Medicine, Department of Internal Medicine, University of Colorado School of Medicine, provided editorial assistance in preparing the manuscript. Carl Miller, MA, Patient and Family Centered Care, University of Colorado Hospital, informed the project from a patient perspective, and Alice Pekarek RN, BSN, Clinical Informatics, University of Colorado Health, provided the nursing informatics perspective. None of these contributors received compensation for their roles.


Results | Of 10 876 PLCO participants with abnormal results on the baseline FSG and follow-up colonoscopy, 3876 were selected for the SCU; 3627 (93.6%) of those selected completed the SCU interview and 2398 underwent a surveillance colonoscopy. Table 1 displays the characteristics of the surveillance colonoscopy cohort. During follow-up (mean length, 8.2 years), 21 cases of incident CRC were observed.

Colorectal cancer incidence rates (per 10 000 person-years) were 6.6, 9.5, and 11.4 for those aged 55 to 69 years, 70 to 74 years, and 75 to 80 years, respectively (Table 2). The proportional hazards model for CRC incidence showed an adjusted hazard ratio of 1.5 (95% CI, 0.7-3.5) for those aged 70 years or older compared with those younger than 70 years.

Discussion | Owing to the small numbers, we cannot estimate the hazard ratio with precision for CRC in those 70 years or older undergoing surveillance colonoscopy. However, the 95% CI of our hazard ratio (0.7-3.5) includes the approximate 2.5-fold increased incidence in those 70 years or older vs those aged 55 to 69 years estimated from the Surveillance, Epidemiology, and End Results database.

Although our study involved participants enrolled in the PLCO trial, diagnostic follow-up of positive screening results, including the initial diagnostic colonoscopy and any surveillance colonoscopy, was performed outside the trial auspices in community settings in 9 metropolitan areas and 1 rural area. As such, these findings are representative of clinical practice. Limitations of our study include the fact that PLCO participants were volunteers in a screening trial, that the initial screening test was FSG and not colonoscopy, and that some patients (6.4%) were nonresponders to the SCU. In contrast, within a single health maintenance organization, institutional factors, including the age and comorbidity of patients selected for surveillance, or the quality of colonoscopy (approximately 40% of malignant neoplasms in the younger age group were found at the initial surveillance examination), could have contributed to the unusual observed outcome. More research is needed to estimate the risks and benefits of surveillance colonoscopy by age.

Paul F. Pinsky, PhD
Robert E. Schoen, MD, MPH

Author Affiliations: Division of Cancer Prevention, National Cancer Institute, Bethesda, Maryland (Pinsky), Department of Gastroenterology, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania (Schoen).

Corresponding Author: Paul F. Pinsky, PhD, Division of Cancer Prevention, National Cancer Institute, 9609 Medical Center Dr, Bethesda, MD 20892 (pp4f@nh.gov).


Author Contributions: Dr Pinsky had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Pinsky.
Acquisition, analysis, or interpretation of data: All authors.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Pinsky.
Obtained funding: Schoen.

Conflict of Interest Disclosures: None reported.

Funding/Support: The Prostate, Lung, Colorectal and Ovarian trial and Study of Colonoscopy Utilization were funded through contracts from the National Cancer Institute.

Role of the Funder/Sponsor: The National Cancer Institute had no role in the design and conduct of the study; collection, management, analysis, and

Table 1. Demographics and Baseline Adenoma Status of Cohort

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No.</th>
<th>Unweighted %</th>
<th>Weighted %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at first surveillance colonoscopy, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>55-69</td>
<td>1678</td>
<td>70.0</td>
<td>67.6</td>
</tr>
<tr>
<td>70-74</td>
<td>533</td>
<td>22.2</td>
<td>23.3</td>
</tr>
<tr>
<td>75-80</td>
<td>187</td>
<td>7.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Male sex</td>
<td>1463</td>
<td>61.0</td>
<td>61.9</td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>2255</td>
<td>94.0</td>
<td>93.1</td>
</tr>
<tr>
<td>Family history of CRC</td>
<td>344</td>
<td>14.3</td>
<td>14.6</td>
</tr>
<tr>
<td>Baseline adenoma status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td>986</td>
<td>41.1</td>
<td>26.1</td>
</tr>
<tr>
<td>Nonadvanced</td>
<td>734</td>
<td>30.6</td>
<td>38.7</td>
</tr>
<tr>
<td>None</td>
<td>678</td>
<td>28.3</td>
<td>35.3</td>
</tr>
</tbody>
</table>

Table 2. CRC Incidence by Age at First Surveillance Colonoscopy

<table>
<thead>
<tr>
<th>Age at First Surveillance Colonoscopy, y</th>
<th>Follow-up, Person-years</th>
<th>No. of CRC Cases (Rate)</th>
<th>Hazard Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55-69</td>
<td>14 192</td>
<td>13 (6.6)</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>70-80</td>
<td>5383</td>
<td>8 (10.0)</td>
<td>1.5 (0.7-3.5)</td>
</tr>
<tr>
<td>70-74</td>
<td>4130</td>
<td>6 (9.5)</td>
<td>1.4 (0.6-3.6)</td>
</tr>
<tr>
<td>75-80</td>
<td>1253</td>
<td>2 (11.4)</td>
<td>1.8 (0.5-6.6)</td>
</tr>
</tbody>
</table>

Abbreviation: CRC, colorectal cancer.

a Computed from raw counts.
b Computed using inverse sampling weights; 1 (reference) for advanced adenoma at baseline, approximately 2 for nonadvanced adenoma and no adenoma at baseline.
COMMENT & RESPONSE

HEALTH CARE REFORM
Selection of Elderly Patients for Colorectal Cancer Screening

To the Editor We read with interest the retrospective cohort study by Tran et al1 that describes the diagnostic yield of colonoscopy as a surveillance tool in elderly patients with a personal history of colorectal cancer (CRC) or precancerous polyps. The study reported a low incidence of CRC and higher complication rate in the elderly population compared with the reference group. Using an institution-based registry involving minority population, we found a fairly high incidence of CRC in the elderly population (2.32%) (mean age, 77.78 years).2 The safety of colonoscopy in elderly patients has been a topic of debate. In our experience, and in many other published studies, colonoscopy has been shown to be safe in the elderly population.3 In our study,4 CRC detection rate was significantly higher in elderly patients who presented with symptoms such as hematochezia or anemia compared with the screening group. This highlights the importance of colonoscopy in a symptomatic elderly population, which can help in diagnosis of CRC at an early stage. In another study,4 we have investigated the impact of comorbidities on the decision regarding the use of CRC screening in the elderly population. We found that 50% patients diagnosed as having colon cancer had a life expectancy of more than 5 years. This suggests that life expectancy based on comorbidity profile and age should be taken into consideration when making a decision regarding the use of CRC screening in elderly patients.4

Another alternative strategy to minimize procedure-related potential risks and improve cost-effectiveness of CRC screening is to prescreen elderly patients with noninvasive methods. We have analyzed the diagnostic yield and cost-effectiveness of prescreening with the fecal occult blood test (FOBT). Interestingly, we found that patients with positive prescreening FOBT results had a higher incidence of precancerous polyps and CRC compared with the group with negative FOBT results. On cost-effectiveness analysis, cost per CRC detected was significantly lower, that is, US $19 666 in the group with positive prescreening FOBT results compared with US $58 000 in the group with negative results (P < .05).5 We recommend that colonoscopy should be considered in elderly patients with a good life expectancy, especially if they develop any symptoms. Noninvasive tests to prescreen can additionally be helpful in patient selection for colonoscopy.

Shashideep Singhal, MD
Kineeh Changela, MD

Author Affiliations: Division of Gastroenterology, Hepatology & Nutrition, The University of Texas, Houston (Singhal), The Brooklyn Hospital Center, Brooklyn, New York (Changela).

Corresponding Author: Shashideep Singhal, MD, Division of Gastroenterology, Hepatology & Nutrition, The University of Texas Health Science Center at Houston, 6431 Fannin St, MSB 4.234, Houston, TX 77030 (ssinghal@gmail.com).

Conflict of Interest Disclosures: None reported.


To the Editor In their Research Letter, Pinsky and Schoen6 evaluate the risk of colorectal cancer (CRC) among elderly patients undergoing surveillance colonoscopy. In contrast to findings from our recent study conducted on the Kaiser Permanente Southern California (KPSC) population,2 their analysis of the Study of Colonoscopy Utilization (SCU) cohort demonstrated an increased risk of subsequent CRC among patients older than 75 years compared with younger age groups.

We believe there are several potential explanations for the discordant findings between the 2 studies. First, the studies were conducted on different populations and involved different methods of patient selection as well as follow-up. The SCU study was conducted via telephone interview among a subset of participants who were followed up as an ancillary study to the larger Prostate, Lung, Colorectal, and Ovarian (PLCO) prevention trial, whereas the KPSC study was conducted within an integrated care setting on data obtained in routine clinical practice. The impact of such differences can be appreciated in the varying age composition of the 2 study cohorts, with 17.4% of patients 75 years or older in the KPSC surveillance cohort compared with 7.8% in the SCU analysis.

One explanation for the lower representation of elderly patients in the SCU study as well as the relatively low CRC incidence detected among elderly patients in the KPSC study is competing risks for mortality in this patient population. Overall mortality was more than 4 times higher among patients 75 years or older compared with the reference population in the KPSC surveillance cohort. Because data for the SCU study was ascertained via telephone query, it is conceivable that patients who died of alternative causes prior to outcome assessment may not have been included. In contrast, exposure time from patients with non-CRC related mortality was included in the KPSC study. Given the low absolute number of CRC cases among patients 75 years or older in both study cohorts (KPSC, n = 5; SCU, n = 2), differences in overall person-time at risk would have a significant impact on estimates of CRC incidence.
Further prospective studies from a variety of practice settings that include comprehensive longitudinal follow-up are needed to clarify the age-related risk of CRC among elderly patients after surveillance colonoscopy. However, an equally important task is to better characterize the spectrum of age-related risks as well as impact of surveillance on overall survival in the elderly population.

We are grateful to Pinsky and Schoen for contributing their findings to the discussion. We hope that additional work will continue to provide much needed insight into this issue so that patients as well as clinicians can make more informed decisions regarding the risks and benefits of ongoing surveillance.

Bechien U. Wu, MD, MPH

Author Affiliation: Center for Digestive Health Research, Division of Gastroenterology, Kaiser Permanente Los Angeles Medical Center, Los Angeles, California.

Corresponding Author: Bechien U. Wu, MD, MPH, Center for Digestive Health Research, Division of Gastroenterology, Kaiser Permanente Los Angeles Medical Center, 1526 N. Edgemont Ave, Los Angeles, CA 90027 (Bechien.u.wu@kp.org).

Conflict of Interest Disclosures: None reported.


LESS IS MORE

Insertion Site for Central Venous Catheters

To the Editor I applaud the new series “Less Is More,” which highlights the concept of cost-conscious care in a concise, reader-friendly format.

In their article demonstrating the costs associated with central venous catheters (CVCs), Patel et al1 suggest that an internal jugular vein site decreases the risk of infection compared with a subclavian vein site. Recognizably, the data on catheter-related complications is plentiful but mostly not conclusive.2-3 Several confounders exist that confuse the picture and require that recommendations be made for specific scenarios (eg, medical vs surgical or trauma intensive care vs other hospitalized patients vs ambulatory patients; cancer vs noncancer patients; hemodialysis vs nonhemodialysis patients; implantable vs tunneled vs peripherally inserted catheters). In addition, the results might vary on the basis of different outcomes, ie, bloodstream infection, thrombosis, and venous stenosis.

A meta-analysis using more recent data found that there was no appreciable difference in rates of infection with subclavian, internal jugular, or femoral site.2 A separate Cochrane Database Systematic Review also concluded that both subclavian and internal jugular vein sites were considered comparable in regard to the risk of infectious and mechanical or thrombotic complications.3 In view of these reviews, it might be appropriate to reconsider the risk of infection attributed to the insertion site.

As recently shown, on average, 20% of physicians are unaware of their patients’ CVCs; thus, it is important for clinicians to keep in mind the recommendation to use central catheters only when absolutely necessary and for as short a period as required. In all, I agree with the authors that further research is needed in this area.

Kleber N. F. de Almeida, MD

Author Affiliation: Comprehensive Infectious Diseases, Wellington, Florida.

Corresponding Author: Kleber N. F. de Almeida, MD, Comprehensive Infectious Diseases, 10115 Forest Hill Blvd, Ste102, Wellington, FL 33414 (dr.dealmeida@yahoo.com).

Conflict of Interest Disclosures: None reported.


To the Editor Patel and colleagues4-101012 wrote that central venous catheters should be placed in the internal jugular vein “which carries a lower risk of infection than the subclavian route.” This statement is unsubstantiated from studies published to date, and this is not the recommendation in recent guidelines.4-9 For short-term, nontunneled central venous catheters inserted in the intensive care unit, our meta-analysis suggested that subclavian insertion is associated with a lower risk of infection.4-6 In addition, the anatomic site used to insert a port for administration of chemotherapy had no effect on infectious and noninfectious complications.3 Ultimately, decisions regarding which anatomic site to insert a central venous catheter depend on patient-specific risk factors (eg, obesity, bleeding diathesis, hyperinflation of the lungs), availability of ultrasound guidance, and experience of the inserter.

Leonard A. Mermel, DO, ScM
Jean-Jacques Parienti, MD, PhD

Author Affiliations: Department of Medicine, Warren Alpert Medical School of Brown University, Providence, Rhode Island (Mermel); Division of Infectious Diseases, Department of Epidemiology & Infection Control, Rhode Island Hospital, Providence (Mermel); Department of Biostatistics & Clinical Research, Côte de Nacre University Hospital Center, Caen, France (Parienti); Risques Microbiens, Faculté de Médecine, Université de Caen Basse-Normandie, Caen, France (Parienti).

Corresponding Author: Leonard A. Mermel, DO, ScM, Division of Infectious Diseases, Department of Epidemiology & Infection Control, Rhode Island Hospital, 593 Eddy St, Providence, RI 02903 (lmermel@lifespan.org).

Conflict of Interest Disclosures: None reported.

