ISSN: 1945-6123

National Cancer Registrars Association

Journal of Registry Management

Spring 2018 | Volume 45 | Number 1

Published by the National Cancer Registrars Association
Founded in 1975 as *The Abstract*

Original Article

Differential Reporting of In Situ Colorectal Cancer in New York State and the United States

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Abstract: Background: Surveillance of colorectal cancer (CRC) at all stages of diagnosis, including in situ, is necessary to have a complete picture of the patterns and trends of this disease. However, registry data suggest that the reporting of in situ CRC is variable. Methods: We used SaTScan statistical software to identify significant clusters of unusual CRC stage distribution in New York State (NYS) among cases diagnosed between 2010 and 2014. These results were compared to the CRC stage distribution within the National Program of Cancer Registries and Surveillance, Epidemiology, and End Results Program (SEER) 18 registries for the same period. We also computed rates and trends by type of reporting source (hospital inpatient vs outpatient surgery center), and reviewed the opinions of several NYS pathologists regarding the dividing line between in situ carcinoma and high-grade dysplasia (HGD). Results: Seven areas within NYS were identified as having a statistically unusual proportion of in situ cases, ranging from 4% in Central New York to 22% on eastern Long Island. Nationally, the percentage ranged from 0.4% in the Seattle–Puget Sound SEER registry to 9.2% in Maryland. Feedback from clinicians revealed diverse opinions about the in situ/HGD boundary. Conclusions: In situ CRC is being reported inconsistently within New York and the United States, and lacks a universally agreed-upon definition. The recent downward trend in in situ CRC reported in the literature may be an artifact of changes in reporting practices.

Key words: *cancer surveillance, colorectal cancer, high-grade dysplasia, in situ, reporting*

Introduction

In situ colorectal tumors are reportable to central cancer registries and are included in databases such as those published by the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (NCI), the Centers for Disease Control and Prevention (CDC)'s National Program of Cancer Registries (NPCR), and the Commission on Cancer's National Cancer Database (NCDB). Despite their potential to contribute useful information to the understanding of patterns and trends and the evaluation of screening programs, they are frequently excluded from analyses. We reviewed several such analyses and none remarked on the reason for their exclusion.[1-7] We suspect that in some instances the decision was made passively, since the default setting in the SEER*Stat software package is to exclude in situ tumors. In others, there may have been legitimate concerns about the imprecise boundary between high-grade dysplasia (HGD) and in situ cancer.[8]

Other studies, in contrast, have incorporated in situ colorectal tumors. In many of these, in situ and localized stage tumors were grouped together. For example, Yang et al grouped in situ and localized tumors in their estimate that 550,000 colorectal cancers (CRCs) were prevented in the United States through screening between 1987 and 2010.[9] Chien et al used the same grouping to evaluate the extent to which CRC survival varied by geographic location and stage at diagnosis.[10] They found significant geographic variation for all stages, though the magnitudes of the variation for the local/in situ grouping were small. Sherman et al used the grouping to identify clusters of late vs early stage CRC in Florida.[11] A study by Wang et al analyzed in situ CRC separately, and identified a significant long-term decline in rates which they attributed to enhanced screening.[12] Chen et al observed the same finding, and attributed the cause to either screening or evolving definitions and terminology related to in situ cancer.[8]

Here, we report on the geographic variation in the proportion of colorectal tumors with in situ stage between states and within New York State (NYS). We explore the reasons for the large observed differences, their impact on cancer registries, and their potential clinical implications.

Methods

All CRCs diagnosed among NYS residents between 2010–2014 recorded in the NYS Cancer Registry as of May 2017 were selected for possible inclusion. These included International Classification of Diseases for Oncology, third edition (ICD-O-3)[13] site codes C18.0–C18.9, C19.9, C20.9, and C26.0, excluding histologies 9050–9055, 9140, and 9590–9992. Because information on tumor stage and geographic location were essential for the analysis, tumors reported only via death certificate or autopsy (n = 402) or that lacked an address or a geocodable address (n = 80) were excluded. Unstageable rectal melanomas (n = 80) were also excluded. The resulting cohort contained 48,713 unique tumors. We defined comparable cohorts for other state registries using publicly available data from the CDC's NPCR and the NCI's SEER Program.[14,15] The SEER cohort included 8 states and

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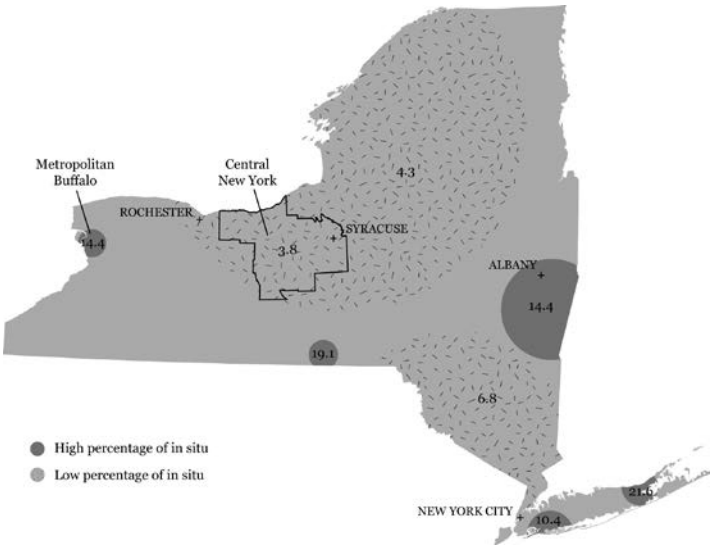
This work was supported in part by the Centers for Disease Control and Prevention's National Program of Cancer Registries through cooperative agreement NU58DP006309 awarded to the New York State Department of Health.

10 metropolitan areas or portions of a state. [15] The NPCR cohort included 45 states, the District of Columbia, and Puerto Rico.[14] The SEER cohort and the NPCR cohort overlapped. Kentucky, Georgia, Louisiana, California, and New Jersey are included in both the SEER and NPCR overall percentages.

For each cohort, we calculated the percentage of colorectal tumors with a stage of in situ, defined as the number with SEER Summary Stage 2000 (SS2000) code 0 divided by the total. This step was repeated after stratifying by type of reporting source (hospital inpatient vs outpatient surgery center). We used Kulldorff's spatial scan statistic[16] to determine the spatial variation of the in situ proportion within NYS. Specifically, we used the Bernoulli model within SaTScan software version 9.4.3[17] to identify high and low clusters of the in situ proportion, defining the in situ tumors as cases and the invasive tumors as controls. In all calculations, tumors with unknown stage (SS2000 code 9) were counted as invasive tumors, as their behavior code value is 3, which excludes in situ as a possible stage.

Based on the SaTScan results, we selected 2 regions of similar underlying risk and similar population size, one with an unusually high proportion of in situ tumors (roughly corresponding to the city of Buffalo and its northern and eastern suburbs, hereafter called *metropolitan Buffalo*) and another with an unusually low proportion of in situ tumors (comprising Onondaga, Oswego, Cayuga, and Wayne counties, hereafter called *Central New York*) for more detailed analysis. Metropolitan Buffalo contained 1,815 tumors with an invasive CRC incidence rate of 41.1 per 100,000 (95% CI, 39.5–42.9) and Central New York contained 1,829 tumors with an invasive CRC incidence rate of 39.9 per 100,000 (95% CI, 38.0–41.9). In situ tumors from these areas were manually reviewed to confirm that the staging was consistent with the accompanying text.

Figure 1. Areas with Unusually High or Low Percentages of Colorectal Cancer Staged as In Situ, New York State, 2010–2014, Relative to Statewide Average of 7.9%



We lastly used the Joinpoint software package[18] to examine longer-term in situ rate trends (2004–2014) for both New York and the 18 SEER registries,[15] stratified by type of reporting source (hospital inpatient vs outpatient surgery center).

Results

SaTScan[17] identified 5 areas within New York with a high proportion of in situ tumors and 2 with a low proportion (Figure 1). In metropolitan Buffalo, 261 of 1,815 colorectal tumors were in situ (14.4%), while in Central New York, 70 of 1,829 were in situ (3.8%), nearly a 4-fold difference. Table 1 lists these results along with additional

Table 1. Percentage of Colorectal Tumors Staged as In Situ (SS2000 Code 0) for Selected Registries and Regions, 2010–2014[14,15]

Area	*All Sources*	*Reports from Outpatient Surgery Centers Only*	*Reports from Hospital Inpatients Only*	*Excluding High-Grade Dysplasia in Text*
New York State	7.9	24.5	4.1	
Metropolitan Buffalo	14.4			6.0
Central New York	3.8			3.5
NPCR	4.7	18.1	4.1	
Maryland	9.2	39.0	5.5	
Washington	1.0	*	0.9	
SEER 18	3.9	10.9	3.7	
Kentucky	6.8	3.6	6.6	
Seattle–Puget Sound	0.4	0.0	0.4	

* Data suppressed due to fewer than 16 cases.

Blank cells are not applicable.

NPCR, National Program of Cancer Registries; SEER, Surveillance, Epidemiology, and End Results.

NPCR = 45 states, Washington DC, and Puerto Rico, including Maryland and Washington. A complete list of states is available at **www.cdc.gov/cancer/public-use**.

SEER = 8 states and 10 geographical areas, including Kentucky and Seattle–Puget Sound. A complete list of registries is available at **https://seer.cancer.gov/registries**.

proportions for the SEER 18 registries,[15] NPCR registries,[14] and selected individual SEER and NPCR registries, which range from 0.4% (Seattle–Puget Sound, SEER) to 9.2% (Maryland, NPCR). The average proportion for NYS (7.9%) was more than double that of the SEER 18 registries (3.9%).

In metropolitan Buffalo, 162 CRC cases were reported with the term *HGD* in the pathology text section of the abstract (62.1% of the in situ cases), while in Central New York, there were 6 (8.6% of the in situ cases). If the 162 HGD cases in metropolitan Buffalo were removed, 6.0% of the remaining CRCs would be in situ (99 of 1,653). A large share of the cases in the metropolitan Buffalo area were reported by a single Buffalo-based facility. This facility reported 188 of 623 colorectal cancers as in situ (30.2%), with 155 of these in situ cases being HGD. If these HGD cases were removed, 7.1% of this facility's colorectal cases would be in situ (33 of 468).

Using the Joinpoint Regression Program,[18] a comparison of in situ rate trends over a decade was made for in situ CRCs in NYS and SEER 18 by reporting source (Figures 2 and 3). NYS in situ CRCs reported by hospital inpatient and SEER 18 show a similar declining trend. The in situ rate trends for the same time period for NYS reported by outpatient surgery centers show an initial decline, but then an increase beginning in 2009.

Discussion

There is a wide range of in situ CRC rates and proportions being reported by central registries nationwide. One possible issue may be the reporting of the term *HGD*. Chen et al pointed out that a change in the terminology being used (high-grade intraepithelial neoplasia instead of adenocarcinoma in situ) may be contributing to the decline in Stage 0 CRCs,[8] as HGD is not a reportable cancer. There is much debate regarding HGD and carcinoma in situ terminology being used in the diagnosis of colon cancer. In 2006, severe dysplasia and carcinoma in situ were considered equivalent to HGD in colorectal adenomas.[19] The American Cancer Society presently describes HGD, intramucosal carcinoma, carcinoma in situ, and carcinoma in the lamina propria as the earliest forms of colon cancer.[20] However, the Facility Oncology Registry Data Standards (FORDS) manual [21] and the SEER Program Coding and Staging Manual[22] instruct for histologies with a behavior code of 2 or 3 in ICD-O-3[14] to be reported; HGD does not meet this criteria. When there are many apparently synonymous terms for the same condition, the line for cancer reporting becomes blurry. While strictly speaking, HGD is not a reportable condition, it may be used to describe a reportable condition (in situ CRC).

In NYS, pathologists are not using the term *HGD* in a consistent fashion. Some use this term interchangeably with carcinoma in situ, while others do not. An informal survey of pathologists at NYS reporting facilities found that some believe that HGD for colon is standard nomenclature and are reporting these cases as carcinoma in situ. Others use HGD to describe a point on a subjective continuum that is less than carcinoma in situ, instead describing a precancerous condition, and therefore not synonymous with carcinoma of any kind. Yet others realize that this is a subjective gray area unique to this site, and while strictly speaking there may be no such thing as in situ carcinoma in the colon,[23] severe dysplasia, HGD, and intramucosal adenocarcinoma should reasonably be considered as equivalent terms for in situ carcinoma. Beyond this informal survey, we are unaware of any efforts to study this question.

The type of reporting source seems to be a factor in the declining in situ CRC rate reported by SEER. We acknowledge that this variable is not rigorously maintained by all registries, and so may not be entirely accurate. Nevertheless, as Figures 2 and 3 demonstrate, the hospital inpatient reporting source in NYS rate trend matches that of SEER 18, and when outpatient surgery centers are included, it accounts for the rising rates of in situ CRCs seen in NYS. Maryland reported the highest proportion of CRC cases as in situ in the United States, and captured 35.9% of these in situ cases through outpatient surgery centers. Seattle–Puget Sound reported the lowest proportion of in situ CRCs and captured zero in situ cases through this type of reporting source. In 2010 alone, an estimated 4.0 million endoscopies of the large intestine (which includes colonoscopies) and

Figure 2. SEER (Surveillance, Epidemiology, and End Results) 18 Reported In Situ Colorectal Cancer Rates (Age-Adjusted to the 2000 US Std Million per 100,000) by Reporting Source, 2004–2014[15]

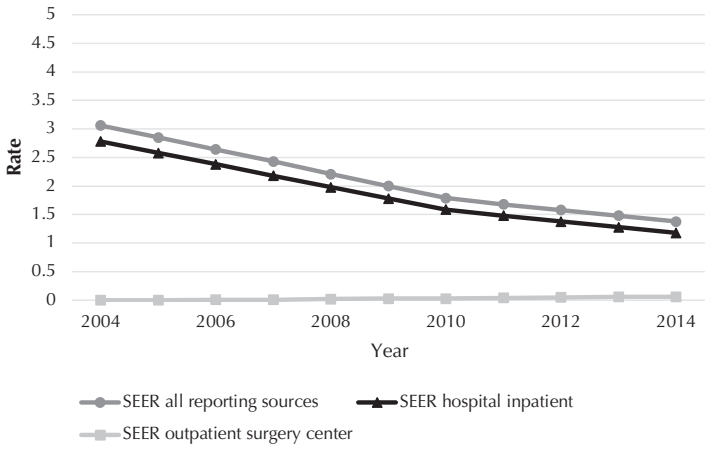
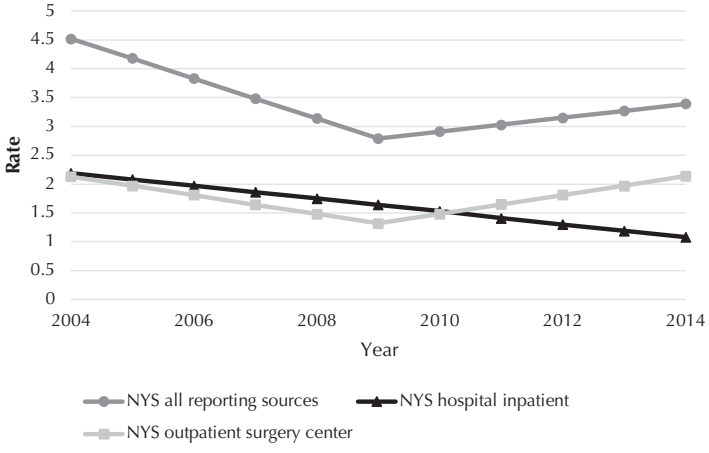


Figure 3. New York State (NYS) Reported In Situ Colorectal Cancer Rates (Age-Adjusted to the 2000 US Std Million per 100,000) by Reporting Source, 2004–2014



1.1 million endoscopic polypectomies of the large intestine were performed in ambulatory surgery centers in the United States.[24] This raises the question: Are SEER and central registries capturing outpatient surgery center CRCs?

Conclusion

We found great variability in the reporting of in situ cancer cases, both between and within registries. Any study that has ever included in situ tumors was potentially biased by this inconsistent reporting. We believe that while most facilities are following similar practices in defining in situ vs HGD, there may be a few practices (such as in metropolitan Buffalo) that are classifying many more cases as in situ. Toll et al show that HGD leads to invasive carcinoma often enough that close clinical management and follow-up is warranted.[25] Fleming et al point out that a diagnosis of HGD or intramucosal carcinoma in a biopsy or polypectomy should not change the decision-making for treatment, as surgical resection needs to be decided based on the overall appearance of the lesion, endoscopic ultrasound results, and endoscopic resectability. [26] But does this mean these HGD cases should be included in in situ cancer statistics? If so, there are potentially profound implications, since being told you have "cancer" and being told you have "dysplasia" elicit quite different psychological responses, even if the treatment is similar.

Our findings highlight the value of clear and unambiguous terminology for counting cancer. Currently the term *HGD* is ambiguous, and leads to spurious differences in CRC in situ rates of an order of magnitude within and between registries. Existing data standards need to be clarified to allow cancer registrars to collect the earliest stage of CRC uniformly. Until then, we would advise against using these data for cancer surveillance and research.

References

1. Henry KA, Sherman RL, Roche LM. Colorectal cancer stage at diagnosis and area socioeconomic characteristics in New Jersey. *Health Place*. 2009;15(2):505-513.
2. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2016. *CA Cancer J Clin*. 2016; 66(1):7-30.
3. Islami F, Kahn AR, Bickell NA, Schymura MJ, Boffetta P. Disentangling the effects of race/ethnicity and socioeconomic status of neighborhood in cancer stage distribution in New York City. *Cancer Causes Control*. 2013;24(6):1069-1078.
4. Kohler BA, Sherman RL, Howlader N, et al. Annual report to the nation on the status of cancer, 1975–2011, featuring incidence of breast cancer subtypes by race/ethnicity, poverty, and state. *J Natl Cancer Inst*. 2015;107(6):djv048.
5. Lai Y, Wang C, Civan JM, et al. Effects of cancer stage and treatment differences on racial disparities in survival from colon cancer: a United States population-based study. *Gastroenterology*. 2016;150(5):1135-1146.
6. May FP, Glenn BA, Crespi CM, Ponce N, Spiegel BMR, Bastani R. Decreasing black-white disparities in colorectal cancer incidence and stage at presentation in the United States. *Cancer Epidemiol Biomarkers Prev*. 2017;26(5):762-768.
7. Murphy CC, Sandler RS, Sanoff HK, Yang YC, Lund JL, Baron JA. Decrease in incidence of colorectal cancer among individuals 50 years or older after recommendations for population-based screening. *Clin Gastroenterol Hepatol*. 2017;15(6):903-909.
8. Chen VW, Hsieh MC, Charlton ME, et al. Analysis of stage and clinical/prognostic factors for colon and rectal cancer from SEER registries: AJCC and Collaborative Stage Data Collection System. *Cancer*. 2014;120(S23):3793-3806.
9. Yang DX, Gross CP, Sovlos PR, Yu JB. Estimating the magnitude of colorectal cancers prevented during the era of screening: 1976 to 2009. *Cancer*. 2014;120(18):2893-2901.
10. Chien LC, Schootman M, Pruitt SL. The modifying effect of patient location on stage-specific survival following colorectal cancer using geosurvival models. *Cancer Causes Control*. 2013;24(3):473-484.
11. Sherman RL, Henry KA, Tannenbaum SL, Feaster DJ, Kobetz E, Lee DJ. Applying spatial analysis tools in public health: an example using SaTScan to detect geographic targets for colorectal cancer screening interventions. *Prev Chronic Dis*. 2014;11(3):E41.
12. Wang H, de Grubb MCM, Gonzalez SJ, Sidani M, Ma J, Zoorob RJ. Temporal trends in colorectal cancer incidence among Asian American populations in the United States, 1994-2013. *Fam Med Community Health*. 2017;5(1):56-64.
13. Fritz A, Percy C, Jack A, et al, eds. *International Classification of Diseases for Oncology*. 3rd ed. Geneva, Switzerland: World Health Organization; 2000.
14. National Program of Cancer Registries and Surveillance, Epidemiology, and End Results SEER*Stat Database: NPCR and SEER Incidence – USCS 2005–2014 Public Use Research Database, United States Department of Health and Human Services, Centers for Disease Control and Prevention and National Cancer Institute. Released August 2017, based on the November 2016 submission. **www.cdc.gov/cancer/npcr/public-use**.
15. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence - SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2016 Sub (2000-2014) <Katrina/Rita Population Adjustment> - Linked To County Attributes - Total U.S., 1969-2015 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, released April 2017, based on the November 2016 submission.
16. Kulldorff M. A spatial scan statistic. *Commun Statist Theory Meth*. 1997;26(6):1481-1496.
17. Kulldorff M. SaTScan™ [computer program]. Version 9.4.3s. Boston, MA: Information Management Services, Inc; 2016. **www.satscan.org**.
18. Joinpoint Regression Program [computer program]. Version 4.5.0.0. Rockville, MD: National Cancer Institute; 2017.
19. Winawer SJ, Zauber AG, Fletcher RH, et al. Guidelines for colonoscopy surveillance after polypectomy: a consensus update by the US Multi-Society Task Force on Colorectal Cancer and the American Cancer Society. *CA Cancer J Clin*. 2006;56(3):143-159.
20. American Cancer Society website. Understanding your pathology report: early adenocarcinoma (cancer) starting in a colon polyp. **https://www.cancer.org/treatment/understanding-your-diagnosis/tests/understanding-your-pathology-report/colon-pathology/adenocarcinoma-starting-in-a-colon-polyp.html**. Updated February 27, 2017. Accessed August 11, 2017.
21. Commission on Cancer. *Facility Oncology Registry Data Standards (FORDS): Revised for 2010*. Chicago, IL: American College of Surgeons; 2010:3.
22. Adamo MB, Johnson CH, Ruhl JL, Dickie LA, eds. *2010 SEER Program Coding and Staging Manual*. NIH Publication number 10-5581. Bethesda, MD: National Cancer Institute; 2010:1.
23. Compton CC, Greene FL. The staging of colorectal cancer: 2004 and beyond. *CA Cancer J Clin*. 2004;54(6):295-308.
24. Hall MJ, Schwartzman A, Zhang J, Liu X. *Ambulatory Surgery Data from Hospitals and Ambulatory Surgery Centers: United States, 2010*. National Health Statistics Reports; no. 102. Hyattsville, MD: National Center for Health Statistics; 2017.
25. Toll AD, Fabius D, Hyslop T, et al. Prognostic significance of high-grade dysplasia in colorectal adenomas. *Colorectal Dis*. 2011;13(4):370-373.
26. Fleming M, Ravula S, Tatishchev SF, Wang HL. Colorectal carcinoma: pathologic aspects. *J Gastrointest Oncol*. 2012;3(3):153-173.