Published in final edited form as:

JAMA Intern Med. 2017 May 01; 177(5): 701–709. doi:10.1001/jamainternmed.2017.0079.

Quality of Cancer Surveillance Clinical Practice Guidelines: Specificity and Consistency of Recommendations

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Abstract

Importance—Primary care providers (PCP's), who are increasingly responsible for caring for the growing population of cancer survivors, may be unfamiliar with appropriate cancer surveillance strategies in this population. Clinical practice guidelines can inform cancer follow-up care and surveillance testing. Vague recommendations and inconsistencies among guidelines can lead to overuse and underuse of healthcare resources and negatively impact cost and quality of survivorship care.

Objective—To examine the specificity and consistency of recommendations for surveillance after active treatment across cancer guidelines.

Design, Setting and Participants—Retrospective cross-sectional analysis of national cancer guidelines from North America and Europe published since 2010 addressing post-treatment care for survivors of the nine most common cancers. We categorized surveillance modalities into history and physical exams, tumor markers, diagnostic procedures (e.g., colonoscopy) and imaging. Within each guideline, we classified individual recommendations into five categories: 1) risk-based recommendation, 2) recommendation for, 3) addressed but no clear recommendation, 4) recommendation against, or 5) not addressed. We reviewed each surveillance recommendation for frequency and stop date, evaluated consistency among guidelines, and analyzed associations between the organizations proposing the guidelines and recommendation characteristics.

Main Outcome Measure—Description of guideline recommendations for cancer surveillance.

Results—We identified 40 guidelines published between January 1st, 2010 and March 1st, 2016. Eighty-five percent were from professional organizations. Ambiguous recommendations (i.e., modality not discussed or discussed without a clear recommendation) were present in 85% of guidelines, and 45% recommended against at least one test. European guidelines were more likely than North American guidelines to contain ambiguous recommendations (72% vs. 100%, $p<0.01$).

Recommendations commonly specified testing frequency (from 89% for history and physical exams to 92% for procedures/imaging) but infrequently provided a definitive stop time. Cross-sectional imaging recommendations varied among guidelines for each cancer. For example, among breast cancer guidelines, surveillance CT scans were recommended *against* in 2, discussed without a clear recommendation in 1, and not addressed in 3 guidelines.

Conclusions—Guidelines addressing the care of cancer survivors have low specificity and consistency. As guidelines continue to be revised, developers should clarify recommendations with simple, non-ambiguous, definitive language for, or against, the use of specific tests to optimize care quality and resource utilization.

Introduction

There are an estimated 33 million living survivors of cancer globally and this number is expected to grow due to a rising cancer incidence in an aging population and improved survival following a cancer diagnosis.^{1,2} Currently, in the United States, one in every 20 people, or 14 million people, meets the definition of cancer survivor;³ this number is expected to grow to 18 million survivors by 2022. Surveillance for recurrent or secondary cancer is a fundamental component of survivorship care.⁴ Depending on the site of primary disease and time since treatment, surveillance modalities can include history and physical exams, tumor markers, direct visualization with endoscopic procedures and radiographic imaging.

Given a growing shortage of oncologists in the US,⁵ survivorship care is increasingly provided by primary care providers (PCPs), physician extenders, and community practitioners.^{6,7} However, PCPs infrequently receive guidance from oncologists regarding appropriate surveillance care⁴ and may lack knowledge and confidence in this area.⁸

To provide optimal survivorship care, PCPs⁹ and professional organizations⁶ have acknowledged the need for clinical practice guidelines with clear recommendations addressing the care of cancer survivors. Given the size of this patient population, their potential vulnerability, and the high cost of some tests used for surveillance testing (e.g. PET scanning), high-quality guidelines in the area of cancer survivorship have the potential to greatly impact value, both by improving clinical outcomes and by controlling costs. In other clinical settings, guidelines have been criticized for vagueness of recommendations¹⁰ and inconsistency,¹¹ limiting their applicability and usefulness to clinicians for determining appropriate care. Characteristics of guidelines related to the care of cancer survivors have not been previously described. We sought to evaluate the specificity of national guidelines containing recommendations about surveillance testing in survivors and to analyze the consistency of recommendations across guidelines addressing the same cancer.

Methods

We performed a cross-sectional analysis of clinical practice guidelines from North America and Europe addressing cancers with the highest estimated number of survivors in the US as identified by the American Cancer Society.² We included 9 cancers (breast, colorectal, non-

small cell lung, prostate, melanoma, uterine corpus, bladder, thyroid, and testicular) which represented 73% of all cancer survivors (10,623,240 people) in the US in 2014.²

Data Sources

We performed an on-line search for publicly available cancer guidelines for each selected cancer. We included any national-level guideline from a government agency or a professional group or society in North America or Europe published in English between January 1st, 2010 and March 1st 2016 addressing post-treatment cancer surveillance. We identified guidelines for inclusion by performing internet searches using relevant keywords (e.g. X, Y), examining web sites of well-established guideline development organizations (e.g., NCCN, NICE) and national societies (e.g., American Society of Clinical Oncology, European Society of Medical Oncology) and querying the Agency for Healthcare Research and Quality's National Guideline Clearinghouse¹² website.. Clinical guidelines that did not contain surveillance recommendations were excluded. After guideline selection was complete, we recorded specific characteristics including organization type (professional or government), year of guideline publication (2010-2013 or 2014-2016) and region of origin (North America or Europe). For each guideline we evaluated aspects of the guideline development process (specification of clinical questions, performance of a systematic review) and the reported strength of evidence in support of surveillance recommendations, based on prioritized elements from the Grading of Recommendation Assessment, Development, and Evaluation (GRADE) system, the RIGHT checklist, and the Institute of Medicine standards for guideline development .^{13,14}

Surveillance Strategies

We categorized methods of surveillance as history and physical exam, tumor marker, diagnostic procedure (e.g., colonoscopy) or imaging. We included any surveillance modality that was addressed by at least one guideline. A team of three experienced clinicians classified recommendation as one of the following types: 1) risk-based recommendation, 2) recommendation for, 3) addressed but no clear recommendation provided, 4) recommendation against, or 5) not addressed. We defined risk-based recommendations as those in which the use of a mechanism of surveillance differed based on the level of risk of recurrence.

Clinical Practice Guideline Specificity and Consistency

To assess for the specificity of each recommendation, we evaluated for inclusion of a surveillance frequency (e.g., tumor marker testing *every 3 months*), the presence of a definitive stop date (e.g., tumor marker testing every 3 months for *1 year*), and the presence of ambiguity (i.e., without a clear recommendation for or against any given test). To evaluate for consistency regarding the same surveillance method for the same cancer, we compared testing recommendations among guidelines addressing the same cancer type. We defined inconsistent guidelines when recommendations did not agree, including when a guideline discussed a test without a clear recommendation or when a test was not discussed at all.

Statistical Analysis

We used descriptive statistics to characterize surveillance methods, recommendation types, specificity and consistency and used Chi-square tests to evaluate associations between guideline sources and recommendation characteristics. Due to small sample size, we did not perform multivariable analysis. Significance was set at 0.05 and all tests were two-sided. All statistical analysis was performed using SAS software (version 9.4; SAS Institute, Cary, NC).

Results

We identified a total of 40 guidelines addressing post-treatment surveillance across the 9 cancer types (Table 1). The number of guidelines per cancer type ranged from 3 to 6 per cancer and a total of 22 specific testing modalities were addressed. Thirty-four guidelines (85%) were from professional organizations, of which 25 (63%) were developed by national societies. Nineteen (48%) guidelines were from North America and most guidelines were published between 2014 and 2016 (65%). Appendix 1 lists all guidelines included by cancer type.¹⁵⁻⁵⁶ Guideline development processes were variable: clinical questions were specified in 11 (28%) guidelines, a systematic review was performed in 14 (35%), and 34 (85%) rated the strength of evidence and/or strength of recommendations. Supporting evidence was weak for the majority of recommendations (Appendix Table 2).

History and physical exams were recommended in most guidelines (89%) across all cancer types, while other forms of surveillance were less commonly addressed and varied more across cancers including imaging (83%), endoscopic procedures (63%) and tumor markers (56%). Ambiguous recommendations (i.e. recommendations neither for nor against a particular modality) were present in 34 (85%) guidelines across cancer types while 18 (45%) guidelines recommended against at least one test. Fourteen (35%) guidelines included risk-based recommendations (Table 1). A recommendation *against* use was included in at least one guideline for 12 of 22 total testing modalities identified, though no test was recommended against consistently. Recommendations for which surveillance modalities to use varied by cancer type and sometimes across guidelines addressing the same cancer type. Some testing modalities were universally recommended across guidelines for a specific cancer type, including mammography in breast, colonoscopy and tumor markers in colorectal, tumor markers in prostate, and ultrasound and tumor markers in thyroid cancer.

Recommendations regarding other surveillance modalities were less consistent. With regard to tumor markers, 2 of 4 (50%) testicular cancer guidelines and 1 of 4 (25%) melanoma guidelines recommended risk-based tumor marker testing; 2 of 6 (33%) breast cancer and 1 of 5 (20%) lung cancer guidelines recommended against tumor marker testing (Figure 1). The tests that were most commonly recommended against were CT imaging in uterine cancer (67% of relevant guidelines) and bone scans in prostate cancer (40%) (Table 2).

PET imaging was recommended by only 1 out of 40 guidelines; this was for bladder cancer (Figure 2). The remainder of guidelines either recommended against or did not address routine PET imaging. Uterine cancer had the most guidelines recommending against the use of PET imaging (67%) followed by lung cancer (60%). The cancer types with the most

guidelines with ambiguous recommendations for PET scans were bladder (83%), prostate (80%), and breast (67%).

Testing frequency was provided for the majority (range 87-92%) of surveillance modalities addressed, but stop times were infrequently provided (range 29-35%). There was no statistically significant difference in testing frequency, inclusion of a stop time, presence of a risk-based recommendation, recommendation against at least one test, or guideline ambiguity by organization type or year of publication. However, there was significant variation in the presence of a stop time recommendation by cancer type (range: 0% for prostate to 67% for bladder cancer, $p<0.01$). In addition, European guidelines were more likely than North American guidelines to contain ambiguous recommendations (72% vs. 100%, $p<0.01$) (Table 3).

Discussion

Clinical practice guidelines addressing cancer surveillance testing are critical tools for clinicians for optimizing care of the large and growing population of cancer survivors. Unclear or imprecise recommendations present challenges for all healthcare providers caring for cancer survivors. The specificity and consistency of recommendations across guidelines is particularly important as survivorship care is increasingly transitioned to PCPs with less familiarity with specific cancers. In this study, we found multiple guidelines from North America and Europe addressing post-treatment cancer surveillance containing recommendations that were often non-specific and inconsistent. In fact, within the same disease, different guidelines often did not address all the same surveillance modalities, and relatively few surveillance modalities were recommended across all guidelines. Our findings are consistent with prior studies addressing the specificity and consistency of guideline recommendations related to both screening¹⁰ and cancer care.⁵⁷

Most surveillance recommendations included a testing frequency, but fewer than one in three provided a definitive stop time. There is a clear decreased risk of recurrence over time for most malignancies and few surveillance modalities are required indefinitely. However, PCPs may be reluctant to halt testing without clear recommendations on when to do so. This will certainly lead to overuse of healthcare resources including potentially invasive procedures. Similarly, specificity in guideline recommendations is key to their usability¹⁰ and lack of recommendation specificity is associated with poor guideline adherence in other clinical contexts.^{58,59} The lack of clarity in cancer surveillance recommendations is particularly relevant as cancer survivors are transitioning earlier after active treatment^{60,61} from oncology providers to PCP's. Just as high-quality guideline recommendations can help clinicians maximize patient benefit and minimize potential harm, a lack of specificity may impede guideline adherence and contribute to either overuse or underuse of care.⁶² Although underuse has been more thoroughly studied, overuse may harm patients by exposing them to unnecessary harmful diagnostic tests and interventions.. Much of the lack of recommendation specificity is likely driven by of the low quality of evidence to inform optimal surveillance strategies in cancer survivors that we documented in our study,⁶³ and clearly poor evidence is a major barrier to the development of high-quality guidelines.⁶⁴ However, developers can optimize guideline usability by maintaining transparency about the

strength of evidence while still making specific recommendations even in the absence of strong evidence.

The Institute of Medicine has stated that guidelines should be valid, reliable, applicable, flexible, clear, and should reflect a multidisciplinary process that can be regularly updated.⁶⁵ The guidelines in our sample fall short in many of these domains which is not unique amongst oncology guidelines.⁶⁶ However, we believe that a number of simple changes to the development of cancer surveillance recommendations would improve their clarity, applicability and therefore their ability to optimize patient outcomes.

First, recommendations about testing should use language that is unambiguous and includes a testing frequency with definitive start and stop intervals.⁵⁹ For example, with respect to surveillance imaging, a guideline could state that a specific test should be performed “every 6 months for the first 2 years, yearly for 3 years and should not be performed after a total of 5 years if there is no evidence of recurrence.” Definitive statements such as “positron emission tomography scans should not be used for surveillance outside of a clinical trial”²¹ should be encouraged and adopted. While shared decision making with patients is critical for optimizing care and clinicians may not apply every recommendation to every patient, clarity and consistency in guideline recommendations, along with transparent evidence ratings, can facilitate communication and patient understanding.

Next, cancer surveillance strategies should include recommendations that are tailored to recurrence risk. There is increasing recognition that risk-based guideline recommendations may optimize outcomes and care value, both generally^{67,68} and specifically in the setting of long-term monitoring of survivors of childhood cancer.⁶⁹ One-third of guidelines in our sample included at least one risk-based recommendation, though in these cases, risk was generally based on stage at diagnosis alone. Robust risk-based follow-up of adult cancer survivors should incorporate factors that are well established from clinical trials and observational data, including cancer and patient characteristics (e.g., stage, grade, genetic mutation status). In colorectal cancer for example, extensive data exists outlining recurrence risk from decades of randomized trials including risk-based models, but these data are not currently incorporated into surveillance recommendations.⁷⁰⁻⁷⁴ The NCCN melanoma guidelines are an example of higher-quality risk-based recommendations³⁶ where patients with stage I-II disease are followed by history and physical exams only, while those with stage III and IV disease undergo more extensive surveillance with cross sectional imaging (e.g., CT scans, MRI) including PET scans. The lack of risk-based recommendations among guidelines in our sample likely reflects the limited data available to help instruct surveillance programs,⁵⁷ indeed the majority of recommendations were based on low-quality evidence. Other barriers to risk-based recommendations include the inherent complexity of developing them and perhaps the perceived challenges with provider interpretation. Nevertheless, risk-based recommendations are likely to provide a more efficient, cost-effective approach to patient follow-up and further incorporation of risk into surveillance recommendations would improve their usefulness.

Third, survivorship guideline development panels should incorporate all stakeholders, including generalist physicians, advanced practice providers, and patient representatives.⁶⁵

Currently, panels developing cancer guidelines are tasked with providing recommendations across the continuum of care, including diagnosis, treatment and post-treatment management. While the panels may be multidisciplinary as recommended by the IOM,⁵⁸ including a variety of oncologic specialists to address the complexity of diagnosis and treatment of cancer, the panels likely contain very few, if any, general practitioners.⁷⁵ Yet, it is often generalists who must translate surveillance recommendations into clinical care. Incorporating the diverse opinions and experiences of all groups impacted by surveillance recommendations may facilitate greater guideline specificity and encourage more active engagement and adherence to guideline recommendations.⁵⁹

The vast majority of recommendations addressing post-treatment care in cancer survivors are made in the context of guidelines addressing the diagnosis and treatment of a particular cancer; in this context, surveillance recommendations are included but not emphasized. Developing surveillance guidelines separately from general cancer care guidelines may allow for the inclusion of more appropriate panelists, better focus, and more specific recommendations. Recently, the American Cancer Society and the American Society of Clinical Oncology¹⁶ published the breast cancer survivorship guidelines, illustrating the advantages of this approach. The guideline focused narrowly on breast cancer care *after* the completion of acute cancer therapy. The survivorship guideline was developed by a multidisciplinary panel that included appropriate stakeholders for surveillance testing (cancer clinicians, generalists, and patients), and made specific and actionable recommendations. More guidelines with focus only on survivorship care could facilitate change and allow developers to focus on improving recommendation quality.

Limitations

There are several important limitations to our study. First, we restricted our search to national cancer guidelines and excluded regional recommendations. This approach excluded provincial clinical practice guidelines in Canada, though they may be widely used and influential.⁷⁶ Nevertheless, including additional guidelines is likely to have increased the variation we found, and would unlikely qualitatively change our results. Second, this study sample was small and we were only able to evaluate the association between guideline characteristics and the specificity and consistency of recommendations using a univariable analysis. Due to the nature of the study and the limited number of guidelines in existence, there was not an alternative methodological approach, and this would only influence the comparative analysis and not our primary findings. Third, there is inherent subjectivity in the interpretation of recommendations. However, we attempted to mitigate this issue by identifying and extracting important data elements to standardize guideline reporting and comparisons. Finally, our study is cross-sectional and offers a snap shot in the status of surveillance clinical practice guidelines up to March 1, 2016. Nevertheless, given the current state of cancer surveillance guidelines it is unlikely that major qualitative changes will occur in the near future.

Conclusion

The number of cancer survivors is growing and optimizing cancer surveillance is an important issue for individual patients, payers and providers. Our review of 40 surveillance

recommendations from clinical practice guidelines across 9 cancer types found a lack of specificity and consistency that hinders optimal patient care. As cancer guidelines are reviewed and revised, we believe developers should clarify recommendations with simple, non-ambiguous, definitive language for, or against, the use of specific tests and specific recommendations based on patient risk.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported in part by the NIH/NCI P30 CA008748 Cancer Center Support Grant.

Appendix 1. Guideline organizations evaluated by cancer type

Cancer Type	Organization
Breast	NCCN, ASCO, ESMO, EUSOMA, RCR, NICE
Colorectal	NCCN, ASCO, ESMO, BSG, NICE
Lung	NCCN, ESMO, ACCP, NICE, ATS
Prostate	NCCN, EAU, ESMO, NICE
Melanoma	NCCN, ESMO, NICE, BAD
Uterine Corpus	NCCN, ESMO, SGO
Bladder	NCCN, NICE ESMO, AUA, ACR, EAU
Thyroid	NCCN, ESMO, ATA
Testicular	NCCN, ESMO, EAU, ASCO

ACR, American College of Radiology; ASCO, American Society of Clinical Oncology; ATA, American Thyroid Association; ATS, American Thoracic Society; AUA, American Urology Association; BSG, British Society of Gastroenterology; BAD, British Association of Dermatology; EAU, European Association of Urology; ESMO, European Society of Clinical Oncology; EUSOMA, European Society of Breast Cancer Specialists; NCCN, National Comprehensive Cancer Network; NICE, The National Institute for Health and Care Excellence; SGO, Society of Gynecologic Oncology

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Figure 1.
Tumor marker clinical practice guideline recommendations by cancer type.

Figure 2.
PET scan clinical practice guideline recommendations by cancer type.

Table 1

Clinical practice guideline characteristics by cancer type.

Characteristic	Breast (n=6)	Colorectal (n=5)	Lung (n=5)	Prostate (n=5)	Melanoma (n=4)	Uterine Corpus (n=3)	Bladder (n=6)	Thyroid (n=3)	Testicular (n=4)	Overall
Survivorship [‡]	3,131,440	1,245,770	430,090	2,975,970	1,045,430	624,890	455,520	470,020	244,110	10,623,240 (73%)
Organization Type										
Government	2 (33%)	1 (20%)	1 (20%)	1 (20%)	1 (25%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)	7 (17%)
Professional	4 (67%)	4 (80%)	4 (80%)	4 (80%)	3 (75%)	3 (100%)	5 (83%)	3 (100%)	4 (100%)	34 (83%)
Professional Society	3 (50%)	3 (60%)	3 (60%)	3 (60%)	2 (50%)	2 (67%)	4 (67%)	2 (67%)	3 (75%)	25 (61%)
Year										
2010-2013	4 (67%)	3 (60%)	2 (40%)	1 (20%)	1 (25%)	1 (33%)	0 (0%)	1 (33%)	2 (50%)	15 (37%)
2014-2016	2 (33%)	2 (40%)	3 (60%)	4 (80%)	3 (75%)	2 (67%)	6 (100%)	2 (67%)	2 (50%)	26 (63%)
Region										
North American	2 (33%)	2 (40%)	3 (60%)	2 (40%)	1 (25%)	2 (67%)	3 (50%)	2 (67%)	2 (50%)	19 (46%)
European	4 (67%)	3 (60%)	2 (40%)	3 (60%)	3 (75%)	1 (33%)	3 (50%)	1 (33%)	2 (50%)	22 (54%)
Frequency provided, n (%)										
History and Physical	4 of 5 (80%)	5 of 5 (100%)	3 of 4 (60%)	1 of 2 (50%)	3 of 3 (75%)	3 of 3 (100%)	1 of 1 (100%)	3 of 3 (100%)	2 of 2 (100%)	25 of 28 (89%)
Tumor markers	n/a	4 of 5 (80%)	n/a	4 of 5 (80%)	n/a	n/a	n/a	3 of 3 (100%)	2 of 2 (100%)	13 of 15 (87%)
Procedures/Imaging	6 of 6 (100%)	5 of 5 (100%)	4 of 4 (100%)	n/a	1 of 1 (100%)	n/a	4 of 5 (80%)	2 of 3 (67%)	2 of 2 (100%)	24 of 26 (92%)
Stop time provided, n (%)										
History and Physical	0 of 5 (0%)	3 of 5 (60%)	0 of 4 (0%)	0 of 2 (0%)	2 of 3 (67%)	1 of 3 (33%)	0 of 1 (0%)	0 (0%)	2 of 2 (50%)	8 of 28 (29%)
Tumor markers	n/a	4 of 5 (80%)	n/a	0 of 5 (0%)	n/a	n/a	n/a	0 (0%)	1 of 2 (50%)	5 of 15 (33%)
Procedures/Imaging	0 of 6 (0%)	3 of 5 (60%)	0 of 4 (0%)	n/a	0 of 1 (0%)	n/a	4 of 5 (80%)	0 (0%)	2 of 2 (100%)	9 of 26 (35%)
Risk based, n (%)	1 (17%)	2 (40%)	1 (20%)	0 (0%)	3 (75%)	0 (0%)	4 (67%)	1 (33%)	3 (75%)	14 of 41 (34%)
Ambiguous Recommendation	4 (67%)	3 (60%)	5 (100%)	4 (80%)	4 (100%)	3 (100%)	6 (100%)	1 (33%)	4 (100%)	34 of 41 (83%)
Recommended against at least one test	3 (50%)	2 (40%)	3 (60%)	4 (80%)	3 (75%)	2 (67%)	0 (0%)	0 (0%)	1 (25%)	18 of 41 (43%)

[‡] American Cancer Society, Surveillance and Health Services Research, Data Modeling Branch Division of Cancer Control and Population Sciences, National Cancer Institute, 2014. Total number of male and female US cancer survivors in 2014 was 14,483,830

Table 2
Procedure and imaging surveillance clinical practice guideline recommendations by cancer type.

Cancer Type	Test	Clinical Practice Guideline Recommendation				Risk Based
		Recommended	No clear recommendation	Recommended against	Not addressed	
Breast	Mammogram	100%	0%	0%	0%	0%
	CXR	0%	17%	33%	50%	0%
	CT scan	0%	17%	33%	50%	0%
	MRI	0%	33%	50%	0%	17%
	U/S	0%	17%	50%	17%	17%
Colorectal	Colonoscopy	100%	0%	0%	0%	0%
	CT scan	60%	0%	0%	0%	40%
Lung	Bronchoscopy	20%	0%	0%	80%	0%
	CT	80%	0%	0%	20%	0%
	Brain MRI	0%	0%	20%	80%	0%
Prostate	Bone scan	20%	0%	40%	40%	0%
	CT	0%	0%	20%	80%	0%
Melanoma	CXR	0%	25%	25%	0%	50%
	CT	0%	25%	25%	0%	50%
	Brain MRI	0%	25%	25%	0%	50%
	U/S	0%	0%	25%	75%	0%
Uterine Corpus	CT	0%	33%	67%	0%	0%
Bladder	Cystoscopy	17%	0%	0%	33%	50%
	CT	33%	17%	0%	0%	50%
Thyroid	U/S	100%	0%	0%	0%	0%
	RAIU	33%	0%	0%	33%	33%
Testicle	CXR	50%	25%	0%	25%	0%
	CT	50%	25%	0%	25%	0%
	Brain CT	0%	0%	0%	75%	25%

CXR, chest x-ray; CT, computed tomography; MRI, magnetic resonance imaging; U/S, ultrasound; RAIU, radioactive iodine uptake scan

Table 3

Comparison between clinical practice guideline characteristics.

	Frequency Provided		Stop Time Provided		Risk Based		Recommended against at least one test		Ambiguous* recommendation	
	n (%)	P-value	n (%)	P-value	n (%)	P-value	n (%)	P-value	n (%)	P-value
Cancer Site		0.15		0.01		0.13		0.16		0.05
Breast (n=6)	6 (100%)		1 (17%)		1 (17%)		2 (33%)		4 (67%)	
Colorectal (n=5)	5 (100%)		5 (100%)		1 (20%)		2 (40%)		3 (60%)	
Lung (n=5)	5 (100%)		1 (20%)		1 (20%)		3 (60%)		5 (100%)	
Prostate (n=5)	4 (80%)		0 (0%)		0 (0%)		4 (80%)		5 (100%)	
Melanoma (n=4)	3 (75%)		2 (50%)		2 (50%)		2 (50%)		4 (100%)	
Uterine Corpus (n=3)	3 (100%)		0 (0%)		0 (0%)		2 (67%)		3 (100%)	
Bladder (n=6)	6 (100%)		4 (67%)		4 (67%)		0 (0%)		6 (100%)	
Thyroid (n=3)	3 (100%)		0 (0%)		1 (33%)		0 (0%)		1 (33%)	
Testicular (n=4)	2 (50%)		2 (50%)		3 (75%)		1 (25%)		4 (100%)	
Organization Type		0.38		0.46		0.93		0.55		0.27
Government (n=6)	6 (100.0%)		3 (50%)		2 (33%)		3 (50%)		6 (100%)	
Professional (n=35)	31 (88%)		12 (34%)		11 (31%)		13 (37%)		29 (83%)	
Year		0.09		0.32		0.6		0.57		0.85
2010-2013 (n=15)	12 (80%)		4 (27%)		4 (27%)		5 (33%)		13 (87%)	
2014-2016 (n=26)	25 (96%)		11 (42%)		9 (35%)		11 (42%)		22 (85%)	
Region		0.37		0.97		0.51		0.7		<0.01
North American (n=19)	18 (95%)		7 (37%)		7 (37%)		8 (42%)		13 (68%)	
European (n=22)	19 (86%)		8 (36%)		6 (27%)		8 (36%)		22 (100%)	
Professional Society		0.11		0.73		0.87		0.45		0.46
Yes (n=26)	22 (85%)		9 (35%)		8 (31%)		9 (35%)		23 (88%)	
No (n=15)	15 (100%)		6 (40%)		5 (33%)		7 (37%)		12 (80%)	

* Either test mentioned without a clear recommendation, or a test was not mentioned