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How Physician Age Affects Surveillance Intensity after Primary Ovarian Cancer Treatment

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Authors' contributions

This work was carried out in collaboration among all authors. Author FEJ designed the study, wrote the protocol, and wrote the first draft of the manuscript. All authors managed the literature searches and analyses of the study. Author FEJ managed the experimental process. All authors read and approved the final manuscript.

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ABSTRACT

Objective: We aimed to determine whether the variability in surveillance strategies after curative-intent primary treatment of ovarian cancer is related to practitioner age.
Materials and Methods: The 943 members of The Society of Gynecologic Oncology (SGO) were surveyed by conventional mail to quantify their surveillance strategies for patients with ovarian carcinoma after potentially curative initial treatment. We requested data regarding the recommended frequency of 10 commonly employed surveillance modalities. Age was used as a proxy for time since formal residency training.
Results: There were 283 responders: 58 were aged 30-39, 114 were aged 40-49, 70 were aged 50-59, and 41 were aged ≥ 60. Older gynecologic oncologists (60+) ordered office visits and pelvic examinations more frequently than younger gynecologic oncologists in year 1 ($p<0.05$). They

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ordered comprehensive metabolic panels more frequently during years 2-4 ($p<0.05$). They ordered CBCs more frequently during years 1-5 and year 10.

Conclusions: Although we had predicted that younger physicians would order surveillance tests more frequently than older physicians, we found the opposite. However, the differences attributable to age were clinically small. The results suggest that physician age does not account for a large portion of the known overall variation in the clinical practice of ovarian cancer patient surveillance after initial treatment. We propose that continuing medical education is a factor that can most plausibly explain this.

Keywords: Age; surveillance; ovarian; carcinoma; outcomes.

1. INTRODUCTION

Harmandayan et al. recently conducted a survey of the members of The Society of Gynecologic Oncology (SGO) to identify the surveillance strategies chosen by these highly credentialed experts in the management of their own patients with ovarian carcinoma following potentially curative primary treatment [1]. The survey results showed that the intensity of surveillance after primary treatment varies markedly among gynecologic oncologists. One potential source of this variation is clinician age, which was not examined in the study of Harmandayan et al. We hypothesized that, if older SGO members had not adjusted their practice patterns to accommodate the many new diagnostic and treatment modalities introduced since completion of their training, they would utilize different tests and/or different testing schedules than their younger colleagues. In view of the prevalent belief that younger doctors order more tests than older doctors, we also hypothesized that our survey would confirm this assertion. To address these hypotheses we reanalyzed the results of the survey to evaluate whether SGO members trained within different time periods follow their ovarian cancer patients in similar ways after primary treatment.

The continual evolution of medical knowledge is translated into changes in physician behavior through formal and informal educational activities. Perspectives on disease processes develop, treatments are upgraded, healthcare environments change, and social norms fluctuate with time. To help physicians react appropriately to these and other variables, postgraduate continuing medical education (CME) is advocated to improve knowledge and appropriately modify physician behavior after the completion of formal training. Though assumed to be valuable, the actual effect of CME is difficult to quantify. Some of this difficulty is due to the variety of formats available to the practitioner, including journal reading, lectures, seminars, formal coursework, conferences, individual clinical experience, etc.

Individual practitioners often view CME as an expensive enterprise that must be endured, as it is required by state licensing boards, professional societies, and hospitals. There is little objective evidence that it affects decision making by individual practitioners. One method by which its effectiveness can be assessed is to measure behavior among practitioners who have completed training at different times [2-7]. One may assume that the behaviors of older clinicians lacking post-residency education would remain relatively unchanged over the span of their careers except for changes arising from experience with their own patients. One might further assume that younger clinicians would encounter additional treatment and diagnostic modalities in their training that the older clinicians had not learned. Measurement of variation in clinical behavior as a function of surgeon age should therefore provide an objective proxy measure of the impact of CME received after formal training. Studies of the effect of surgeon age on surveillance strategies for patients after potentially curative treatment for colon cancer, rectal cancer, lung cancer, and upper aerodigestive tract cancer have found no appreciable effect [2-5]. However, both Tsai et al. [6] and Sakata et al. [7] did detect significant effects of practitioner age on surveillance intensity after curative-intent treatment for patients with prostate cancer and extremity soft tissue sarcoma, respectively, but they clinically were quite small.

2. MATERIALS AND METHODS

All 943 members of SGO, including candidate members, were surveyed by conventional mail to determine their surveillance strategies for patients with ovarian carcinoma after potentially curative treatment. All members received a cover letter outlining the purpose of the study along

with the survey instrument and a self-addressed, stamped return envelope. No monetary or other incentives were offered to participants. The full details of the methods and initial results have been published [1]. In brief, the survey consisted of two main components. The first part was concerned with demographic information and determined whether the surgeon performed ovarian cancer surgery and if he/she also participated in long-term surveillance. Only those who were performing such surgery and providing long-term postoperative surveillance at the time of the mailing were asked to complete the entire survey. The second part of the survey contained four vignettes, each depicting idealized patients with ovarian cancer who were otherwise healthy and had previously undergone uncomplicated potentially curative surgery for ovarian carcinoma ± adjuvant therapy.

In each vignette, the patient described had curative-intent initial treatment but each featured a different Federation Internationale de Gynecologie et d'Obstetrique (FIGO) stage and/or amount of residual disease (stage I, stage II, stage III with < 1 cm residual disease after maximal debulking, and stage III with > 1 cm residual disease after maximal debulking). The cover letter, the four vignettes, and the survey instrument are available on request (mutchd@wudosis.wustl.edu). SGO members were asked to describe their surveillance schedule after appropriate curative-intent surgery for each patient described in the four vignettes. Each member was asked to indicate the number of annual office visits and surveillance tests he/she would recommend in years 1-5 and 10 after completion of initial therapy. A list of all surveillance tests reported to be clinically relevant was compiled after a thorough review of the current pertinent literature and an informal survey of local gynecologic oncologists confirmed that the list contained all tests in current use. Tests performed in the office (pelvic examination, Pap smear, complete blood count, comprehensive metabolic panel, serum CA-125 level, transvaginal ultrasonogram [US], and chest x-ray) and tests routinely performed in a hospital outpatient setting (abdominal-pelvic CT, chest CT and abdominal-pelvic CT) were all included.

On receipt of the completed surveys, the data were entered into a computerized database and analyzed. Variation in clinical behavior as a function of surgeon age was used as a proxy measure of the impact of CME received after formal training. The number of times a particular modality was used in a particular year across all years and all modalities was fitted by a generalized linear model with a Poisson distribution. Because of insufficient sample size to fit a full model considering age, timing, clinical vignettes, and their interactions, the effect of age on practice patterns was assessed at each time point instead, while adjusting for the effect of clinical vignettes. In each model, a generalized estimating equation was used to account for potential correlation among different clinical vignettes from the same respondent [8]. The p-values were adjusted for multiple comparisons and to control the false positive rate [9]. The statistical analysis was performed using SAS (SAS Institutes, Cary, NC). An adjusted p-value of 0.05 or less was taken to indicate statistical significance and all tests were two-sided.

3. RESULTS

Of the 943 SGO members sent the initial mailing, 620 did not respond even after a second mailing. Of the 323 SGO members who responded, 40 were excluded because they were retired, did not perform surgery for ovarian cancer, did not fully complete the survey, and/or did not perform long-term surveillance. Thus, 283 responses were evaluable. Of these, 58 (20%) were between the ages of 30 and 39, 114 (40%) were between the ages of 40 and 49, 70 (25%) were between the ages of 50 and 59, 36 (13%) were between the ages of 60 and 69, and 5 (2%) were 70+. The male to female ratio was 3.46:1. Approximately one-third of responders were in private practice (94, 33%) with the rest practicing in academic (176, 62%), government (7, 3%), or other (6, 2%) settings.

Table 1 shows the mean ± standard deviation (SD) for each surveillance modality, stratified by surgeon age, across the initial 5 years and year 10. Since none of the interactions between age and stage were statistically significantly different, we chose to present the summary statistics for FIGO stage 1 only. Stage 1 is a common stage at diagnosis, particularly in developed countries. It comprises about 22% of cases in the USA [10]. Older gynecologic oncologists (60+) recommended office visit, metabolic panel, and CBC significantly more frequently than younger surgeons but the differences were small. Table 2 shows the mean and SD of self-reported utilization. This provides a conservative depiction of the variability. Table 3 shows the median (minimum, maximum), which emphasizes the variability.

Table 1. Surveillance practice patterns of SGO members, stratified by surgeon age and year post-surgery

Modality	Surgeon age		Year Post-surgery					
			1	2	3	4	5	10
Office visit		N	276	276	275	275	274	260
	30-39		3.9±0.4	3.7±0.5	2.6±0.8	2.2±0.6	2.0±0.6	1.1±0.4
	40-49		4.3±1.2	3.7±0.5	2.7±1.0	2.2±0.7	2.0±0.7	1.1±0.4
	50-59		4.2±1.0	3.5±0.7	2.3±0.7	2.0±0.4	1.9±0.5	1.1±0.5
	60+		4.7±2.1	3.5±0.9	2.7±0.7	2.2±0.5	2.0±0.7	1.2±0.7
		p value	<0.05	NS	NS	NS	NS	NS
Pelvic exam		N	276	274	273	273	272	256
	30-39		3.9±0.4	3.7±0.6	2.5±0.8	2.2±0.6	2.0±0.6	1.1±0.4
	40-49		4.3±1.3	3.7±1.0	2.7±1.0	2.2±0.7	2.0±0.7	1.1±0.5
	50-59		4.2±1.0	3.5±0.7	2.3±0.7	2.0±0.4	1.9±0.5	1.1±0.5
	60+		4.6±2.5	3.4±1.0	2.6±0.8	2.2±0.6	1.9±0.7	1.2±0.7
		p value	<0.05	NS	NS	NS	NS	NS
Pap smear		N	269	267	267	266	264	248
	30-39		1.2±0.9	1.2±0.9	1.0±0.5	1.0±0.5	1.0±0.5	0.9±0.3
	40-49		1.2±1.6	1.1±1.4	1.0±0.9	0.9±0.7	0.8±0.6	0.7±0.5
	50-59		1.3±1.2	1.1±0.9	1.0±0.7	0.9±0.6	0.9±0.6	0.8±0.4
	60+		1.2±0.9	1.1±0.9	1.1±0.6	1.0±0.7	1.0±0.6	0.8±0.4
		p value	NS	NS	NS	NS	NS	NS
CBC		N	264	261	259	259	257	246
	30-39		0.8±1.6	0.5±0.9	0.4±0.6	0.4±0.6	0.3±0.6	0.3±0.4
	40-49		1.5±2.5	0.7±1.1	0.5±0.9	0.5±0.8	0.4±0.7	0.3±0.5
	50-59		1.4±1.5	1.0±1.2	0.7±0.8	0.6±0.7	0.6±0.7	0.4±0.5
	60+		2.7±2.7	1.8±1.6	1.2±0.9	1.0±0.7	0.9±0.7	0.6±0.5
		p value	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Comprehensive metabolic panel		N	259	257	255	256	253	242
	30-39		0.7±1.4	0.4±0.9	0.3±0.6	0.3±0.6	0.3±0.6	0.2±0.4
	40-49		1.0±1.9	0.6±0.9	0.4±0.7	0.4±0.6	0.4±0.6	0.3±0.5
	50-59		1.2±1.5	0.8±1.1	0.5±0.7	0.5±0.7	0.5±0.7	0.3±0.5
	60+		2.0±2.2	1.3±1.1	0.9±0.8	0.8±0.6	0.8±0.6	0.6±0.5
		p value	NS	< 0.05	<0.05	<0.05	NS	NS
Serum CA-125 level		N	274	273	272	272	269	254
	30-39		4.0±0.7	3.6±0.6	2.6±0.8	2.2±0.6	2.0±0.8	1.0±0.5
	40-49		4.3±1.8	3.6±1.4	2.6±1.3	2.2±1.0	2.0±0.9	1.0±0.6
	50-59		4.0±1.2	3.4±1.0	2.3±1.0	2.0±0.6	1.8±0.6	1.1±0.6
	60+		4.4±2.0	3.5±1.0	2.6±0.8	2.3±0.8	2.0±0.8	1.1±0.7
		p value	NS	NS	NS	NS	NS	NS
Chest x-ray		N	260	256	256	255	254	240
	30-39		0.5±0.6	0.4±0.6	0.5±1.2	0.4±0.5	0.3±0.5	0.2±0.4
	40-49		0.5±0.9	0.3±0.7	0.2±0.6	0.2±0.5	0.2±0.4	1.0±0.3
	50-59		0.5±0.6	0.4±0.6	0.3±0.5	0.3±0.5	0.3±0.5	0.2±0.4
	60+		0.7±0.7	0.7±0.7	0.6±0.7	0.5±0.7	0.5±0.5	0.4±0.5
		p value	NS	NS	NS	NS	NS	NS
Abdominal-pelvic CT		N	260	259	259	257	255	240
	30-39		0.4±0.7	0.3±0.6	0.2±0.4	0.2±0.4	0.3±1.2	0.1±0.2
	40-49		0.6±0.8	0.3±0.6	0.2±0.5	0.2±0.4	0.2±0.4	0.0±0.2
	50-59		0.5±0.7	0.4±0.6	0.4±1.2	0.1±0.3	0.2±0.4	0.0±0.2
	60+		0.9±0.9	0.6±0.8	0.5±0.6	0.3±0.5	0.3±0.5	0.2±0.4
		p value	NS	NS	NS	NS	NS	NS

Modality	Surgeon age		Year Post-surgery					
			1	2	3	4	5	10
Chest CT		N	254	253	251	250	248	237
	30-39		0.0±0.2	0.0±0.2	0.0±0.1	0.0±0.0	0.0±0.0	0.0±0.0
	40-49		0.1±0.5	0.1±0.4	0.1±0.3	0.1±0.3	0.0±0.2	0.0±0.1
	50-59		0.0±0.2	0.0±0.2	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0
	60+		0.1±0.3	0.1±0.2	0.1±0.2	0.0±0.2	0.0±0.2	0.0±0.0
		p value	NS	NS	NS	NS	NS	NS
Transvaginal ultrasonogram (US)		N	259	257	255	256	253	242
	30-39		0.1±0.2	0.0±0.2	0.0±0.2	0.0±0.2	0.0±0.2	0.0±0.2
	40-49		0.4±1.6	0.3±1.3	0.2±0.8	0.2±0.6	0.1±0.6	0.1±0.3
	50-59		0.2±0.8	0.2±0.8	0.2±0.6	0.1±0.6	0.1±0.5	0.0±0.2
	60+		0.2±0.5	0.2±0.5	0.1±0.4	0.1±0.3	0.1±0.3	0.1±0.3
		p value	NS	NS	NS	NS	NS	NS

Data for all four clinical vignettes are grouped and displayed as the mean ± SD of the number of times a particular modality was requested in a particular year. The analysis was adjusted for multiple measures. N: the number of evaluable responses per matrix cell of 283 respondents. NS = not significant

Table 2. Frequency of recommended surveillance modalities in years 1-5 and 10 for the vignette featuring Stage I ovarian carcinoma*

Modality	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Office visit	4.0±1.1	3.5±0.9	2.4±0.8	1.2±0.6	1.9±0.7	1.1±0.5
Pelvic exam	4.0±1.1	3.5±0.9	2.4±0.8	2.1±0.6	1.9±0.6	1.1±0.6
Pap smear	1.2±1.3	1.1±1.1	1.0±0.7	0.9±0.6	0.9±0.5	0.8±0.4
CBC	1.2±2.0	0.7±1.1	0.5±0.7	0.5±0.7	0.4±0.6	0.3±0.5
Comp. metabolic panel	0.9±1.6	0.6±1.0	0.4±0.6	0.4±0.6	0.4±0.6	0.3±0.5
Serum CA-125 level	4.0±1.5	3.4±1.1	2.4±1.0	2.1±0.8	1.9±0.8	1.0±0.5
Chest x-ray	0.5±0.7	0.4±0.7	0.3±0.8	0.3±0.5	0.3±0.5	0.2±0.4
Abdomen/pelvis CT	0.5±0.7	0.3±0.6	0.3±0,7	0.2±0.4	0.2±0.7	0.1±0.2
Chest CT	0.1±0.4	0.0±0.3	0.0±0.2	0.0±0.2	0.0±0.2	0.0±0.1
Transvaginal US	0.2±1.1	0.2±1.0	0.1±0.6	0.1±0.5	0.1±0.4	0.1±0.2

**The number in each cell is the number of times a particular modality is recommended in a particular post-treatment year. These data present all values from all evaluable responses for the vignette featuring a patient with FIGO Stage I cancer as mean ± one SD. This depiction of the data gives a conservative impression of the variability in practices. CT, computed tomography; US, ultrasonogram*

Table 3. Frequency of recommended surveillance modalities in years 1-5 and 10 for the vignette featuring Stage I ovarian carcinoma*

Modality	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Office visit	4 (0, 12)	4 (0, 12)	2 (0, 6)	2 (0, 6)	2 (0, 6)	1 (0, 6)
Pelvic examination	4 (1, 12)	4 (0, 12)	2 (0, 6)	2 (0, 6)	2 (0, 6)	1 (0, 6)
Pap smear	1 (0, 12)	1 (0, 12)	1 (0, 6)	1 (0, 4)	1 (0, 3)	1 (0, 2)
CBC	1 (0, 14)	0 (0, 4)	0 (0, 4)	0 (0, 4)	0 (0, 3)	0 (0, 1)
Comp. metabolic panel	0 (0, 14)	0 (0, 4)	0 (0, 3)	0 (0, 2)	0 (0, 2)	0 (0, 2)
Serum CA-125 level	4 (0, 12)	4 (0, 12)	2 (0, 6)	2 (0, 6)	2 (0, 6)	1 (0, 3)
Chest x-ray	0 (0, 6)	0 (0, 4)	0 (0. 9)	0 (0, 3)	0 (0, 2)	0 (0, 1)
Abdomen/pelvis CT	0 (0, 4)	0 (0, 3)	0 (0. 9)	0 (0, 2)	0 (0, 9)	0 (0, 1)
Chest CT	0 (0, 4)	0 (0, 3)	0 (0. 2)	0 (0, 2)	0 (0, 2)	0 (0, 1)
Transvaginal ultrasonogram	0 (0, 12)	0 (0, 12)	0 (0. 6)	0 (0, 4)	0 (0, 4)	0 (0, 2)

**The number in each cell is the number of times a particular modality is recommended in a particular post-treatment year. These data present all values from all evaluable responses for the vignette featuring a patient with FIGO Stage I cancer as median (minimum, maximum). This depiction of the data emphasizes the variability in practices. CT, computed tomography; US, ultrasonogram*

This indicates that surveillance strategies among SGO members are quite homogeneous and that practitioner age is not an important determinant of clinical care. The effect of surgeon age on surveillance intensity cannot account for the overall variation in practice in this important area of medical care.

4. CONCLUSION

It is often asserted that younger clinicians tend to order more tests than older clinicians. However, there is little research on this topic. We hypothesized that younger surgeons would be more likely to recommend more surveillance tests as this seems to be a common belief among gynecologic oncologists. Our data indicate that older clinicians order certain tests slightly more frequently than younger clinicians. Since ovarian carcinoma survivors are common, and since most have received chemotherapy, bone marrow failure is also relatively common. This may explain why CBCs are ordered more often by older clinicians who have followed their patients for many years. Similarly, old survivors are prone to develop diseases of the aged such as diabetes and heart failure, which could account for the slightly increased utilization rate of comprehensive metabolic panels by older clinicians. Whether gynecologists who are NOT SGO members utilize similar surveillance strategies is unknown, as far as we are aware.

Surveys offer an alternative method by which to assess knowledge and judgment. In order to avoid many of the subtleties that are often embedded within clinical practice decisions, the vignettes offered in surveys are structured and idealized. By factoring out the many unknowns inherent within clinical practice, well-defined clinical vignettes and a menu of potential options for selection facilitates accurate analysis. Survey instruments allow for relatively unambiguous isolation of factors affecting selection of management options. However, such surveys do not guarantee that the results match actual practice and, as such, further complementary studies of the actual practice patterns of surgeons performing surveillance after potentially curative surgery of ovarian carcinoma are warranted. No prior studies empirically measuring the impact of surgeon age on the practice of ovarian cancer surveillance exist, to our knowledge.

This analysis demonstrates that the age of the gynecologic oncologist does affect practice to a small extent. Since we had only a 30% response rate and this study was one of the first to evaluate how practitioner age affects variability in ovarian cancer surveillance strategies, the power of this study is fairly limited. The effect of post-surgery year on surveillance intensity is large. This survey did not evaluate how clinicians react based upon tests obtained, nor can it address whether the test ordering pattern affects patient outcomes. To answer such questions, randomized clinical trials are likely to be required. In fact, a recent trial found no survival benefit from routine measurement of serum CA 125 levels [11]. However, our analysis does confirm that surveillance intensity varies minimally by clinician age.

The goal of CME is to promote uniformity of practice within the boundaries of acceptable patient care by maintaining the knowledge base of clinicians throughout their careers. Although such standardization can reduce waste and increase efficiency, achieving such results requires considerable resources in effort, expense, and time. There is some concern about whether the immense cost of CME in time, effort, and money that arise as a result are justifiable [12]. In this sample of self-reported practitioner behavior, CME appears to be effective in producing relatively uniform practice in ovarian carcinoma patient surveillance among clinicians of varying ages. The frequency of recommended surveillance testing varies by patient factors, such as years post-surgery, tumor grade and size, but only marginally and nonlinearly by the age of the surgeon caring for such patients. We propose that CME is the only plausible factor which can explain the results of this analysis; it seems to standardize practice patterns. However, this analysis cannot distinguish between clinical experience, formal conferences, and informal discussions among clinicians, journal reading, and the like, as to their relative importance.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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