Results From Four Rounds of Ovarian Cancer Screening in a Randomized Trial

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OBJECTIVE: To test whether annual screening with transvaginal ultrasonography and CA 125 reduces ovarian cancer mortality.

METHODS: Data from the first four annual screens, denoted T0–T3, are reported. A CA 125 value at or above 35 units/mL or an abnormality on transvaginal ultrasonography was considered a positive screen. Diagnostic follow-up of positive screens was performed at the discretion of participants' physicians. Diagnostic procedures and cancers were tracked and verified through medical records.

RESULTS: Among 34,261 screening arm women without prior oophorectomy, compliance with screening ranged from 83.1% (T0) to 77.6% (T3). Screen positivity rates declined slightly with transvaginal ultrasonography, from 4.6 at T0 to 2.9–3.4 at T1–T3; CA 125 positivity rates (range 1.4–1.8%) showed no time trend. Eighty-nine invasive ovarian or peritoneal cancers were diagnosed; 60 were screen detected. The positive predictive value (PPV) and cancer yield per 10,000 women screened on the combination of tests were similar across screening rounds (range 1.0–1.3% for PPV and 4.7–6.2 for yield); however, the biopsy (surgery) rate among screen positives decreased from 34% at T0 to 15–20% at T1–T3. The overall ratio of surgeries to screen-detected cancers was 19.5:1. Seventy-two percent of screen-detected cases were late stage (III/IV).

CONCLUSION: Through four screening rounds, the ratio of surgeries to screen-detected cancers was high, and most cases were late stage. However, the effect of screening on mortality is as yet unknown.

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See related editorial on page 772.

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Carcinoma of the ovary continues to be the leading cause of death from gynecologic malignancies in the United States. In 2007, it is expected that 22,400 women in the United States will develop this disease and more than 15,200 will die, resulting in a very high case fatality rate.[1] Women diagnosed with early stage (I/II) ovarian cancer have substantially better survival rates compared with those diagnosed in later stages.[2] The hypothesis behind screening for ovarian cancer is that earlier detection of the disease

will result in more women being diagnosed at less advanced stages, and that this "stage shift" will translate into lower overall mortality rates for ovarian cancer.

Both transvaginal ultrasonography[3–5] and the serum biomarker CA 125[6–8] have been used to screen for early ovarian cancer. Studies to date, however, have not demonstrated a clear effect of screening with transvaginal ultrasonography or CA 125 on mortality from ovarian cancer. The Prostate, Lung, Colorectal and Ovarian (PLCO) cancer screening trial has as one of its objectives to estimate, in healthy women aged 55 through 74 years at entry, whether screening with both CA 125 and transvaginal ultrasonography can reduce mortality from ovarian cancer. Results from the initial screening round for ovarian cancer for the 39,115 women randomly assigned to the intervention (screening) arm of the PLCO trial were reported earlier.[9] The salient findings from that report were that a large number of oophorectomies were performed relative to the number of invasive cancers detected (about a 30:1 ratio) and that the majority of the cancers detected (80%) were stage III and above. The present report extends that initial analysis to the first four rounds of screening in the trial, and covers test compliance, screen positivity results, diagnostic follow-up, and numbers and characteristics of cancers detected. In addition, the report also examines interval cancers, ie, those cancers not diagnosed through screening. Of specific interest, the analysis of these data from the subsequent screening rounds will enable a determination of whether the above-cited trends, namely, the high ratio of surgeries to detected cancers and the unfavorable stage distribution of the screen-detected cancers, persist past the initial round of screening.

MATERIALS AND METHODS

The design of the PLCO trial has been described in detail elsewhere.[10] Briefly, the objective of the ovarian cancer component was to estimate, in healthy subjects aged 55–74 years at entry, whether screening with CA 125 and transvaginal ultrasonography reduces mortality from ovarian cancer. Prostate, lung, and colorectal cancers are also being studied.

In this trial, half of the subjects were randomly assigned to receive specific, scheduled PLCO cancer screening examinations (intervention arm) and the other half to receive only their usual care (control arm). The ovarian cancer screening regimen in PLCO consisted of annual CA 125 tests and transvaginal ultrasound examinations for 4 years (T0–T3), plus two additional rounds of screening with CA 125 only (T4,T5). Enrollment was initiated in 1993 and completed in 2001. Participants are being followed for at least 13 years from enrollment. Ten screening centers are participating: the University of Colorado Health Sciences Center; Lombardi Cancer Research Center of Georgetown University; Pacific Health Research Institute, Honolulu; Henry Ford Health System; University of Minnesota School of Public Health/Virginia L. Piper Cancer Institute; Washington University School of Medicine; University of Pittsburgh, Pittsburgh Cancer Institute and Magee-Women's Hospital; Huntsman Cancer Institute at the University of Utah; Marshfield Clinic Research Foundation; and the University of Alabama at Birmingham. Each institution obtained local institutional review board approval to carry out the trial.

The target population for the ovarian component of the PLCO trial included women aged from 55 to 74 years who had not been diagnosed previously with lung, colorectal, or ovarian cancer. Criteria for exclusion included current treatment for cancer other than nonmelanoma skin cancer, and enrollment in another cancer screening or prevention trial. Initially, women who had undergone oophorectomy were ineligible, but in 1996 this restriction was lifted because a low accrual of women threatened to jeopardize screening end points for lung and colorectal cancer. Women who reported having had a bilateral oophorectomy on the baseline questionnaire were considered ineligible for ovarian tests and are therefore not included in these analyses. Women who reported having had a prior oophorectomy at any given screening year were considered ineligible for all subsequent tests.

Transvaginal ultrasonography was performed by qualified ultrasonographers using a 5–7.5 MHz transvaginal probe. The examiner imaged both ovaries in the transverse and longitudinal planes. At least 5 minutes were spent looking for each ovary to ensure an adequate search; however, if the iliac vessels were visualized without ovaries being seen, the examiner concluded the search for the ovaries. Ovaries were measured along the major and minor axes in both transverse and longitudinal planes, and the prolate ellipsoid formula (width×height×thickness×0.523) was used to calculate the volume of each ovary and/or cyst. The following transvaginal ultrasonography test results were classified as positive: ovarian volume more than 10 cm^3; cyst volume more than 10 cm^3; any solid area or papillary projection extending into the cavity of a cystic ovarian tumor of any size; or any mixed (solid/cystic) component within a cystic ovarian tumor.

We measured CA 125 on serum obtained and frozen within 2 hours of blood being drawn at each of

the 10 screening centers. All sample testing was performed centrally at the University of California, Los Angeles Immunogenetics Laboratory. Samples were shipped on dry ice and stored at –70°C; CA 125 results of 35 units/mL or more were classified as positive.

Results of the screening tests were sent to both the participants and their personal physicians within 3 weeks of specimen submission. Evaluation and follow-up of positive screening tests were at the discretion of participants' physicians; the PLCO trial did not specify a diagnostic algorithm. Medical records of diagnostic procedures performed after positive screens were obtained by screening center study personnel and recorded on standardized reporting forms. To track cancers not diagnosed through screening, study participants were sent annual study update forms which asked about any cancer diagnoses. Pathology reports from relevant neoplasms were abstracted by trained certified tumor registrars at the respective screening centers. This report covers all confirmed ovarian and peritoneal cancers diagnosed in women in the intervention arm in the 4-year period after randomization.

For purposes of this report, screen-detected cancers were defined as those diagnosed as a result of investigations initiated after a positive screening test, with no lapse in the diagnostic evaluation exceeding 9 months. Non–screen-detected cancers in women who received prior PLCO screens were denoted as interval cancers. "Never screened" cancers were defined as cancers diagnosed in women who did not receive any PLCO screening tests for ovarian cancer.

The χ^2 test was used to assess the statistical significance of differences in proportions. A two-tailed $P<.05$ was considered statistically significant.

RESULTS

Of 39,115 women randomly assigned to receive screening, 4,854 had undergone prior oophorectomy, leaving 34,261 who were considered eligible for screens at randomization; these women are the participants in the current analysis. Demographics and medical history for these participants are shown in Table 1. Almost 65% were aged 55–64 years and most, 88.6%, were non-Hispanic white. The population was highly educated, with approximately 30% being college graduates. Just more than one quarter (27.3%) had prior hysterectomy, and a bit more than one half (53.6%) had a history of oral contraceptive use.

Of 34,261 women eligible for screening, 30,630 (89%) received at least one screen during the four rounds. The proportion of eligible women receiving both tests decreased slightly over the study years, from 83.1% at baseline (T0) to 77.6% at T3 (Table 2). Compliance rates were essentially the same for transvaginal ultrasonography and CA 125, although slightly lower for the former, and the overwhelming majority of women receiving one test received both tests. Of note, approximately one third (32%) of the more than 5,000 women who were not screened at T0 received at least one screen during the next three rounds.

Screening results are shown in Table 3. The percentage of women who tested positive on at least one test was slightly lower in years T1–T3 (4.9, 4.6, and 4.5%) than at T0 (5.8%). In each screening year, a significantly greater proportion of transvaginal ultrasound examinations were positive (4.6%, 3.4%, 2.9%, and 2.9% at T0–T3, respectively) than CA 125 tests (1.4%, 1.6%, 1.8%, and 1.7%) ($P<.001$). Approximately one half of the positive transvaginal ultrasound examinations in the study years subsequent to

Table 1. Demographics and Medical History of Eligible Intervention Arm Participants (N=34,261)

	%
Age (y)	
55–59	34.1
60–64	30.4
65–69	21.9
70–74	13.6
Race	
White (non-Hispanic)	88.6
African American (non-Hispanic)	5.7
Hispanic	1.5
Asian	3.4
Education	
Less than high school	6.5
High school graduate	40.0
Some college	23.1
College graduate	15.5
Postgraduate	14.8
Prior hysterectomy	27.3
History of oral contraceptive use	53.6
Number of live births	
None	9.3
1	7.6
2–4	64.9
5+	18.2
Personal history of breast cancer	3.6
Family history of cancer	
Breast	14.8
Ovarian	4.0
Breast and ovarian	0.5

For all variables except age, percentages exclude missing values. On average, approximately 3% of responses were missing for these variables.

Table 2. Compliance With Screening Tests

	Screening Round			
	T0	T1	T2	T3
Total eligible	34,261	33,319	32,707	32,114
% Compliant				
TVU	83.1	81.2	79.6	77.7
CA 125 compliant	83.9	82.4	81.0	79.0
Either compliant	83.9	82.4	81.0	79.1
Both compliant	83.1	81.1	79.5	77.6

TVU, transvaginal ultrasonography.

T0 were newly positive tests. For CA 125, the proportion of positives that were newly positive decreased from 60% at T1 to 34% at T3. Across all screening rounds, among the 30,630 women who received at least one screening test, 11.1 % had at least one positive result. For the individual tests, 8.1% had at least one positive transvaginal ultrasound examination and 3.4% had at least one positive CA 125 test. Screen positivity rates showed relatively little variability across the 10 screening centers; the coefficient of variation of the positivity rates across centers was around 35% for transvaginal ultrasonography and 20% for CA 125.

The number of women with a positive screen, the number biopsied as a result of that screen, and the number of neoplasms and invasive cancers identified are presented in Table 4; results stratified by screening modality are presented in Table 5. Of note, the large majority of biopsies were oophorectomies performed either with laparotomy or laparoscopy. Among all women who screened positive by either transvaginal ultrasonography or CA 125, the proportion undergoing biopsy decreased significantly over the study years, going from 33.8% at T0 to 19.7% at T1, 14.9% at T2 and 13.8% at T3 ($P<.001$). In contrast, of women who did undergo biopsy, the percentage diagnosed with invasive (ovarian or peritoneal) cancer increased significantly over the study years, going from 3.2% at T0 to 9.5% at T3 ($P<.001$). Putting these two trends together to examine the positive predictive value (PPV) of the screening tests for invasive cancer (ie, the percentage of positive screens that resulted in a diagnosis of invasive ovarian or peritoneal cancer), it was seen that PPV was relatively constant, and quite low, over the screening years–1.1% (95% confidence interval [CI] 0.6–1.6), 1.0% (95% CI 0.4–1.5), 1.1% (95% CI 0.5–1.7), and 1.3% (95% CI 0.6–2.0), respectively, at T0–T3. The yield of invasive cancers per 10,000 screens was also relatively stable over time–6.2 (95% CI 3.4–9.2), 4.7 (95% CI 2.2–7.3), 5.2 (95% CI 2.5–8.0), and 5.9 (95% CI 2.9–8.9), respectively, at T0–T3. Over all screening rounds, of the 3,388 women who had at least one positive screening result on either test, 1,170 (34.5%) received a biopsy at some point as diagnostic follow-up; of these, 5.1% (n=60) had invasive cancer diagnosed on biopsy.

The two individual tests, CA 125 and transvaginal ultrasonography, differed significantly in terms of both the proportion of positives who underwent biopsy and the proportion of women biopsied who had invasive cancer. The biopsy rate was considerably higher after a positive transvaginal ultrasound examination than a positive CA 125, although for both tests this rate significantly decreased from T0 to T1–T3; for transvaginal ultrasonography, the rate

Table 3. Transvaginal Ultrasonography and CA-125 Screening Results

	Screening Round			
	T0	T1	T2	T3
n (receiving at least one screening test)	28,746	27,541	26,584	25,423
% Positive				
Either test	5.8	4.9	4.6	4.5
TVU	4.6	3.4	2.9	2.9
CA 125	1.4	1.6	1.8	1.7
Both tests	0.12	0.08	0.08	0.05
First positive TVU	–	1.9	1.3	1.3
First positive CA 125	–	0.9	0.9	0.6

TVU, transvaginal ultrasonography.

Table 4. Follow-Up of Positive Screens of Either Type

	Screening Round			
	T0	T1	T2	T3
Screened				
n	28,746	27,541	26,584	25,423
Positive				
n	1,675	1,341	1,224	1,148
% of screened	5.8	4.9	4.6	4.5
Biopsies				
n	566	264	182	158
% of positive	33.8	19.7	14.9	13.8
Neoplasms*				
n	27	17	15	15
% of biopsies	4.8	6.4	8.2	9.5
% of positive (PPV)	1.6	1.3	1.2	1.3
Yield per 10,000 screened	9.3	6.1	5.6	5.9
Invasive cancers (ovarian or peritoneal)				
n	18	13	14	15
% of biopsies	3.2	4.9	7.7	9.5
% of positive (PPV)	1.1	1.0	1.1	1.3
Yield per 10,000 screened	6.2	4.7	5.2	5.9

PPV, positive predictive value.
* Includes invasive cancers and ovarian cancers of limited malignant potential.

dropped from 40.6% at T0 to 17–24% at T1–T3 ($P<.001$), whereas for CA 125 the rate dropped from 15.6% at T0 to 9–12% at T1–T3 ($P=.01$). Among those biopsied, the percent diagnosed with invasive cancer was much greater for CA 125 (21.0% at T0 and 18.8–28.2% at T1–T3) than for transvaginal ultrasonography (2.3% at T0 and 4.1–4.4% at T1–T3) ($P<.001$). PPVs were twofold to threefold higher for CA 125 (range 2.1–3.2) than for transvaginal ultrasonography (range 0.7–1.1) ($P<.001$); for neither test was there a clear trend over time. The yields of the two tests were generally similar, ranging from 2.0 to 4.2 (per 10,000) for transvaginal ultrasonography and from 3.2 to 4.8 for CA 125.

Table 5. Follow-Up of Positive Transvaginal Ultrasound Examination and CA 125 Screens

	TVU Screening Round				CA 125 Screening Round			
	T0	T1	T2	T3	T0	T1	T2	T3
Screened								
n	28,478	27,047	26,049	24,949	28,732	27,514	26,556	25,402
Positive								
n	1,309	930	766	734	403	434	481	427
% of screened	4.6	3.4	2.9	2.9	1.4	1.6	1.8	1.7
Biopsies								
n	531	225	137	123	62	48	56	39
% of positives	40.6	24.2	17.9	16.8	15.6	11.1	11.7	9.1
Neoplasms*								
n	21	14	6	5	14	9	14	11
% of biopsies	4.0	6.2	4.4	4.1	22.6	18.8	25.0	28.2
% of positives (PPV)	1.6	1.5	0.8	0.7	3.5	2.1	2.9	2.6
Yield per 10,000 screened	7.3	5.1	2.3	2.0	4.8	3.2	5.2	4.3
Invasive cancers (ovarian or peritoneal)								
N	12	10	6	5	13	9	13	11
% of biopsies	2.3	4.4	4.4	4.1	21.0	18.8	23.2	28.2
% of positives (PPV)	0.9	1.1	0.8	0.7	3.2	2.1	2.7	2.6
Yield per 10,000 screened	4.2	3.6	2.3	2.0	4.5	3.2	4.8	4.3

TVU, transvaginal ultrasonography; PPV, positive predictive value.
* Includes invasive cancers and cancers of limited malignant potential.

Table 6. Stage of Invasive Cancers by Test Result and Study Year

		Stage I/II		Stage IIIA		Stage IIIB		Stage IIIC		Stage IV	
	All n	n	%	n	%	n	%	n	%	n	%
Test result (in y of diagnosis)											
Neither positive*	14	2	14.3	1	7.1	1	7.1	8	57.1	1	7.1
CA 125 positive (only)	27	3	11.1	3	11.1	1	3.7	17	63.0	3	11.1
TVU positive (only)	14	10	71.4	1	7.1	1	7.1	0	0.0	2	14.3
Both positive	19	4	21.1	0	0.0	1	5.3	12	63.2	2	10.5
Not done	15	2	13.3	1	6.7	0	0.0	10	66.7	2	13.3
Study y/method of diagnosis											
Screen detected at T0	18	3	16.7	1	5.6	2	11.1	10	55.6	2	11.1
Screen detected at T1	13	4	30.8	1	7.7	1	7.7	7	53.8	0	0.0.
Screen detected at T2	14	3	21.4	1	7.1	0	0.0	8	57.1	2	14.3
Screen detected at T3	15	7	46.7	1	6.7	0	0.0	4	26.7	3	20.0
Interval*	19	2	10.5	2	10.5	1	5.3	11	57.9	2	10.5
Never screened	10	2	20.0	0	0.0	0	0.0	7	70.0	1	10.0
All*	89	21	23.6	6	6.7	4	4.5	47	52.8	10	11.2

TVU, transvaginal ultrasonography.
Table includes invasive ovarian and peritoneal cancers.
* Staging not available for one subject.

Of 17 low malignant potential tumors, 14 (82%) were screen detected. Of the screen-detected low malignant potential tumors, 12 had been positive on transvaginal ultrasonography alone, one on CA 125 alone, and one had been positive on both tests. Nine of the 14 were detected at T0.

The stage of cancers according to screening result and study year of diagnosis is shown in Table 6. The 17 low malignant potential tumors are not included in the table; all but two were stage I, with one being stage II and one stage III. Eighty-nine women in the screening arm were diagnosed with (invasive) ovarian cancer during the T0–T3 time period. Sixty (67%) of these cancers were screen detected. Nineteen screen-detected cancers (32%) had abnormalities in both transvaginal ultrasonography and CA 125 in the year of diagnosis; of these, 15 (79%) were stage III or greater. Forty-one cancers were discordantly positive for either CA 125 only (n=27) or transvaginal ultrasonography only (n=14); 89% of the CA 125 (only) detected cancers were stage III or greater as compared with only 29% of the transvaginal ultrasonography (only) detected cancers ($P<.001$). Of note, 15 of 18 (83%) screen-detected cancers at T0 were stage III or greater; this proportion decreased modestly, and not statistically significantly, to 67% (28 of 42) at T1–T3. Of 19 interval cancers, 16 (84)% were stage III or greater (one was of unknown stage). Of these 16, the median CA 125 value at the last screen was 13 units/mL; 14 were primary ovarian and two were peritoneal cancers.

The majority of cancers (61%) were serous cystadenocarcinomas; the proportion with this histology was similar among both the screen-detected (58%) and the non–screen-detected (66%) cancers. Twelve cancers (13.5%) were peritoneal; eight of these were screen detected, all by CA 125.

DISCUSSION

At the baseline screening round, a total of 566 surgeries were performed as diagnostic follow-up to positive screens, resulting in a diagnosis of 18 invasive cancers–the ratio of surgeries to invasive cancers was thus 31 to 1. Of the 18 cancers, 83% were stage III or IV. Over three subsequent annual rounds of screening, there were 604 additional surgeries after positive screens and 42 more screen-detected invasive cancers, giving a ratio of surgeries to cancers of 14 to 1; 67% of these cancers were stage III or above. Thus, during subsequent screening rounds, although the number of surgeries required to detect a cancer was halved from the baseline round, this ratio remained somewhat elevated, and the stage distribution of the detected cancers was only minimally improved. Over all four rounds of screening, the surgery to detected cancer ratio was 19.5 to 1, and 72% of screen-detected cancers were late stage.

The above statistics reflect the complementary nature of the two screening tests being evaluated. The high rate of surgeries derives primarily from positive transvaginal ultrasound examinations. At baseline, 94% of surgeries (biopsies) performed after positive screens were done in women with positive transvaginal ultrasound examinations; this decreased marginally to around 80% for study years T1–T3. At baseline, the surgery to detected cancer ratio after a

positive transvaginal ultrasound examination was 44 to 1, as compared with 23 to 1 during subsequent screening rounds. In contrast, after a positive CA 125 test, the ratio of surgeries to cancers was approximately 4.5 to 1 at both the baseline and subsequent screening rounds. However, although the rate of "unnecessary" surgeries was much increased with transvaginal ultrasonography as compared with CA 125, transvaginal ultrasonography was also the test that detected the earlier stage cancers.

In the original report based on the baseline screening round results only, there were only 18 (screen-detected) cancers, which limited the ability to perform subanalyses. Now, with 60 screen-detected cases, the pattern is clearer. The cases detected through transvaginal ultrasonography only (ie, with normal CA 125), tended to be early stage; 71% of an admittedly small sample of 14 cases were stage I or II. Cases with elevated CA 125, however, regardless of whether they had an abnormal transvaginal ultrasonography, were primarily late stage, 89% of 27 cases with normal transvaginal ultrasonography and 79% of 19 cases with abnormal transvaginal ultrasonography. Of the 17 screen-detected stage I/II cases, 10 (59%) were detected by transvaginal ultrasonography alone.

An interesting finding here was that the biopsy rate after a positive screen decreased from T0 to T1–T3. For transvaginal ultrasonography, the decrease was from 40.6% at baseline to 17–24% at T1–T3, whereas for CA 125, the drop-off was from 15.6% at T0 to 9–12% at T1–T3. For CA 125, this decrease is explained by examining first positive screens over subsequent rounds. Among women with a first positive CA 125 screen at T1–T3, the biopsy rate was 14.8%, essentially equivalent to the T0 biopsy rate of 15.6%; thus first positive CA 125 tests at later rounds were followed up similarly to baseline round positives. In contrast, among repeat CA 125 positives, the average biopsy rate over T1–T3 was only 7%. For transvaginal ultrasonography, however, even among the first positives at later rounds, the biopsy rate remained substantially lower (on average 23%) than the rate at baseline of 40.6%. The biopsy rate for repeat positive transvaginal ultrasound examinations averaged 16%. We are currently investigating whether the specific findings on abnormal transvaginal ultrasound examinations (eg, cyst size, ovary size) may help explain the discrepancy in biopsy rates from baseline to subsequent rounds.

The large number of surgeries (primarily oophorectomies) prompted by a positive screen and not resulting in a cancer diagnosis here, 1,086 (or 3.5% of all women screened) should be seen in context of the background rate of oophorectomies in women of this age group. An essentially equivalent number (1,080) of oophorectomies (without a cancer finding) were performed on this cohort during this time period for reasons other than follow-up of a positive screen. Thus, while oophorectomies for other purposes were not uncommon, this screening program using CA 125 and transvaginal ultrasonography effectively doubled the oophorectomy rate in this cohort during the period of screening.

Several recent studies of screening with CA 125 and transvaginal ultrasonography had produced results generally similar to those observed here. In a trial of ovarian cancer screening in the United Kingdom, Menon et al[11] used a sequential regimen of CA 125 followed (in some instances) by transvaginal ultrasonography. On the basis of CA 125 and age, women were assigned a risk score, and those with high enough scores were then offered repeat CA 125 and/or transvaginal ultrasonography. Of 6,532 women (median age 59.7 years) receiving an initial screen, 16 underwent surgery based on screening findings, and five were diagnosed with ovarian malignancy. These numbers translate into a cancer yield of 7.7 per 10,000 women screened and a biopsy to detected cancer ratio of 3.2 to 1. Because all women in the U.K. study had to have elevated CA 125 to proceed to diagnostic follow-up, these figures are perhaps most appropriately compared with the corresponding PLCO results from women with a positive CA 125, which were a yield (at baseline) of 5.2 per 10,000 and a biopsy to detected case ratio of approximately 4.5 to 1. Thus, the two studies demonstrated quite similar findings.

In a Japanese trial of CA 125 and transvaginal ultrasonography screening for ovarian cancer, among 41,688 women (median age 58) randomly assigned to an intervention group, the yield of ovarian cancer was 3.1 per 10,000 women screened at the initial round and 3.8–7.4 per 10,000 women screened at later rounds (two through five).[12] This range for the yield in later rounds was quite comparable to that seen in PLCO (4.7–5.9), although the initial round yield was lower than the PLCO yield of 6.2. The overall ratio of surgeries to detected cancers was 33 to 1, a bit higher than the 19.5 to 1 ratio for PLCO. A total of 67% of the Japanese screen-detected cases (n=27) were stage I/II, compared with 29% in PLCO.

In conclusion, over three subsequent postbaseline annual screening rounds, the ratio of surgeries to detected cancers decreased somewhat from that observed in the baseline round, but still remained rather

high at 14 to 1. As at baseline, the majority of screen-detected cancers were stage III and above. Transvaginal ultrasonography continued to account for most of the unnecessary surgeries in the subsequent rounds, but also for most of the early stage cancers. These data are consistent with the current guidelines of the U.S. Preventive Services Task Force that state that ovarian screening with CA 125 and transvaginal ultrasonography is not recommended. A determination on whether screening with these two modalities will reduce ovarian cancer mortality must await the final results of the PLCO trial.

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