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RESEARCH ARTICLE

Adherence to Cervical Cancer Screening Guidelines Among Women Aged 66–68 Years in a Large Community-Based Practice

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Introduction: The 2012 national cervical cancer screening guidelines recommended cessation of screening after age 65 years in women with adequate prior screening. In this retrospective cohort study, adherence to these screening exit guidelines was examined.

Methods: Women who turned age 66 years in 2012–2013 at Kaiser Permanente Southern California were followed through age 68 years for cervical cancer screening uptake. Adequacy of prior screening was assessed between age 56 and 65 years using electronic medical records. Guideline adherence was determined based on screening pattern between age 66 and 68 years. Patient- and physician-level correlates for guideline adherence were examined using multivariable logistic regression. Data collection and analyses were conducted in 2018.

Results: A total of 14,778 women were included; 24% did not have adequate prior screening by age 65 years. Among those without adequate prior screening, the proportion screened after age 65 years ranged from 71% (177 of 249) in those whose most recent test was abnormal to 3% (34 of 1,330) in those who did not have any testing in 10 years. Prior screening pattern was the only factor associated with screening after age 65 years. Of those with adequate prior screening, 10% (1,135 of 11,295) continued to receive screening after age 65 years. Frequent office visits and having a male primary care physician were associated with continuing screening after age 65 years.

Conclusions: A considerable proportion of women did not have adequate prior screening by age 65 years. Of these, a large proportion did not receive screening after age 65 years, except those who had a recent abnormal screening result. Further research is needed to understand barriers for guideline adherence and rationales for clinical decision making.

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INTRODUCTION

The U.S. Preventive Service Task Force recommended against cervical cancer screening in women aged >65 years with adequate prior screening history and who are not otherwise at high risk for cervical cancer in their 2003, 2012, and 2018 guidelines, based on evidence that suggested little benefit of screening in these women.[1–3] Adequate prior screening was defined as 3 consecutive negative cytology results or 2 consecutive negative co-test results within 10 years before screening exit, with the most recent test occurring within the past 5 years. The same recommendations are endorsed by the American College of Obstetrics and Gynecology and the American Cancer Society.[4]

Cancer screening is sensible only when benefits outweigh harms.[5,6] In older women at low risk of cervical

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cancer, false positive screening results may induce anxiety, and screening tests, diagnostic colposcopy, and biopsy procedures may become unnecessary burdens.[7–9] By contrast, it is important that women without evidence for being at low risk (i.e., adequate prior screening history) continue to be offered screening even after reaching age 65 years.[6] In fact, approximately 20% of women with cervical cancer were diagnosed after age 65 years.[10,11] Data from national cancer registries show that after adjustment for hysterectomy status, the incidence of cervical cancer does not decline with age until after age 85 years.[12]

To date, adherence to cervical cancer screening exit guidelines is unclear and needs to be better understood. Objectives of this study were to examine cervical cancer screening practices and correlates for guideline adherence among women aged 66–68 years in a large community-based practice to identify potential gaps in guideline adherence and inform the need for interventions to optimize cervical cancer screening practices in older women.

METHODS

Study Population

This retrospective cohort study was conducted at Kaiser Permanente Southern California (KPSC), the largest integrated healthcare delivery system in Southern California. KPSC serves >4 million members who are broadly representative of the racial/ethnic and socioeconomic diversity of the population in this geographical area.[13] Preventive measures including cervical cancer screening are offered without additional fee-for-service cost for members. For Medicare-eligible women, KPSC offers Medicare Advantage Plans; therefore, Medicare women receive care exclusively at KPSC. Clinical guidelines at KPSC, including those for cervical cancer screening, are generally consistent with national guidelines. This study was approved by the KPSC's IRB.

Women who met the following inclusion criteria were eligible for the study: (1) turning age 66 years between 2012 and 2013 and (2) being alive and maintaining KPSC membership between age 56 and 68 years. This membership criterion was applied to allow assessment of a full 10 years of screening history before age 66 years to determine adequacy of prior screening per clinical guidelines, and to allow a full 3 years of follow-up to assess screening practice after age 65 years. Women who met the following exclusion criteria were not eligible for the study: (1) had a hysterectomy that removed the cervix before age 69 years (i.e., women with supracervical hysterectomy were not excluded; this was done to allow a full 3 years of eligible follow-up after age 65 years), (2) had a diagnosis of cervical cancer before age 66 years, or (3) had HIV infection before age 66 years, for whom a different surveillance schedule is recommended. Women were followed from the first day of age 66 years to end of age 68 years to assess their cervical cancer screening utilization.

Measures

Data were collected using KPSC's electronic health records. The outcome of interest was cervical cancer screening between age 66 and 68 years. Adequacy of prior screening was determined based on screening history between age 56 and 65 years. Pap and human papilloma testing (as in co-testing) results were identified from the laboratory database and the cytopathology database. Women who met the following criteria were categorized as having adequate prior screening: 3 consecutive negative cytology results or 2 consecutive negative co-test results between age 56 and 65 years, with the most recent test occurring within the past 5 years. All other women were considered without adequate prior screening, who were further divided into the following subcategories: (1) had an abnormal test result from the most recent screening, (2) had an abnormal test result but not from the most recent screening, (3) did not have any abnormal finding in the past 10 years but did not have sufficient screening done (i.e., 3 Pap tests or 2 co-tests with the most recent one done in the recent 5 years), and (4) no screening in the past 10 years. An abnormal test result was defined as any findings other than a negative result. For Pap testing, atypical squamous cells of undetermined significance or worse was considered abnormal; for human papilloma testing, a positive result was considered abnormal.

Patient characteristics of interest included race/ethnicity; census block education and income level; co-morbidity status (as Charlson's index); and healthcare utilization in the year before age 66 years including number of office visits, any emergency room visit or hospitalization, and influenza vaccination (as a measure of other preventive service use). Provider characteristics of interest included primary care provider's sex and years of practice at KPSC. Information on census block income and education level were obtained from geocoding data using the residential address. Chronic co-morbid condition and healthcare utilization were captured within 12 months before age 66 years.

The clinical guidelines from the American Society of Colposcopy and Cervical Pathology recommended at least 20 years of surveillance screening after diagnosis of a cervical intraepithelial neoplasia Grade 2 or worse regardless of age.[14] Therefore, the authors additionally performed chart review of the screening visits for 10% randomly sampled (n=106) women who had adequate prior screening but continued to receive cervical cancer screening after age 65 years to assess if screening continuation was for surveillance because of a prior cervical intraepithelial neoplasia Grade 2 diagnosis. Chart review was performed because pathologic diagnoses cannot readily be extracted electronically.

Statistical Analysis

The distributions of demographic and clinical characteristics of the study cohort were calculated overall and by prior screening status (adequate versus inadequate versus subcategories within inadequate); differences were assessed using t-tests or chi-square tests. Next, the proportion of women receiving cervical cancer screening between age 66 and 68 years was calculated by prior screening status. In a sensitivity analysis, these calculations were repeated excluding those with a screening test within 2 years before age 66 years. This allowed 5 years of observation after the last screening test, as KPSC transitioned from a 3-year to 5-year co-testing interval for women aged ≥30 years during the study follow-up period. The proportion screened between age 66 and 68 years was also evaluated separately for those with an abnormal test result within or not within the 2 years before age 66 years.

To evaluate correlates for guideline adherence, bivariate and multivariable modified Poisson regressions with robust error variance were conducted to estimate RRs,[15] stratified by prior screening status (adequate and inadequate). The outcomes of the

Poisson regression models were lack of adherence to the screening exit guidelines, defined as continued screening between age 66 and 68 years for those with adequate prior screening, and lack of screening between age 66 and 68 years for those without adequate prior screening. All aforementioned women's and providers' characteristics were considered in the regression analyses as potential correlates to guideline adherence. As women are clustered within physicians, the modified Poisson regression models accounting for clustering effects were used to estimate RRs.[15] All analyses were conducted in 2017–2018, using SAS, version 9.3.

RESULTS

A total of 140,721 women reached age 66 years in 2012–2013. Of these, 20,242 were alive and maintained KPSC membership between age 56 and 68 years. After excluding those with a total hysterectomy (n=5,435), prior cervical cancer (n=19), and HIV infection (n=10), 14,778 were included in the analysis (Appendix Figure 1, available online). Table 1 shows the demographic and clinical characteristics of the study subjects. Between age 56 and 65 years, 11,287 (76%) had adequate prior screening and 3,491 (24%) did not have adequate prior screening. Women with and without adequate prior screening differed in several demographic and clinical characteristics. Among women with inadequate prior screening, 43% (n=1,495) had normal screening results but not sufficient screening, 38% (n=1,330) had no test done, and the rest had at least 1 abnormal test result 19% (n=666).

Of women with adequate prior screening, 10% received cervical cancer screening after age 65 years (Table 2). Of those without adequate prior screening, 88% did not receive screening between age 66 and 68 years. The proportion screened among those without adequate prior screening varied drastically depending on the subcategory (Table 2). Among those whose most recent screening before age 66 years had abnormal findings, 71% continued to be screened. Among those who had an abnormal finding that was not from the most recent screening, 35% continued to be screened. Among those with only normal findings but insufficient screening, 5% continued to be screened. Among those who did not have any screening in the past 10 years, only 3% were screened between age 66 and 68 years.

In the sensitivity analysis excluding those with a recent screening within 2 years before age 66 years, the

Table 1. Characteristics of the Study Population by Prior Screening Status Between Age 56–65 Years

Characteristics	Total (n=14,778)	Adequate (n=11,287, 76%)	Inadequate (n=3,491, 24%)	p-value[a]
Race/ethnicity, n (%)				**<0.01**
White, non-Hispanic	7,996 (54.1)	6,114 (54.2)	1,882 (53.9)	
Black, non-Hispanic	1,677 (11.4)	1,218 (10.8)	459 (13.2)	
Asian	1,717 (11.6)	1,389 (12.3)	328 (9.4)	
Hispanic	2,829 (19.1)	2,238 (19.8)	591 (16.9)	
Others	297 (2.0)	206 (1.8)	91 (2.6)	
Unknown	262 (1.8)	122 (1.1)	140 (4.0)	
Percent of adults with high school diploma by Census block, mean (SD)	83.1 (13.3)	83.5 (13.3)	81.9 (13.5)	**<0.01**
Median household income dollars by Census block, Mean (SD)	68,856 (27,062)	69,825 (27,157)	65,712 (26,514)	**<0.01**
Received influenza vaccination, n (%)[b]	9,571 (64.8)	7,803 (69.1)	1,768 (50.6)	**<0.01**
Office visits, mean (SD)[b]	9.8 (11.2)	10.3 (11.1)	8.2 (11.3)	**<0.01**
ER visits, mean (SD)[b]	0.2 (0.7)	0.2 (0.8)	0.2 (0.7)	0.87
Hospitalizations, mean (SD)[b]	0.1 (0.4)	0.1 (0.4)	0.1 (0.5)	0.98
Charlson's co-morbidity index, mean (SD)	0.8 (1.1)	0.8 (1.1)	0.8 (1.2)	0.05
PCP, male sex, n (%)	7,057 (47.8)	5,314 (47.1)	1,743 (50.2)	**<0.01**
PCP specialty,[c] n (%)				0.39
Family medicine	8,646 (58.6)	6,585 (58.4)	2,061 (59.4)	
Internal medicine	6,005 (40.7)	4,622 (41.0)	1,383 (39.8)	
Other	106 (0.7)	78 (0.7)	28 (0.8)	
PCP years of practice, mean (SD)	13.6 (8.9)	13.8 (8.9)	13.1 (8.8)	**<0.01**
PCP age (years), mean (SD)	46.7 (8.9)	46.7 (8.7)	46.5 (9.3)	**0.01**

Note: Boldface indicates statistical significance (p<0.05).
[a]p-values from t-test for continuous variables and chi-squared test for categorical variables.
[b]Within 12 months before age 66 years.
[c]Percentage does not add up to 100% because of missing data.
ER, emergency room; PCP, primary care physician.

Table 2. Proportions With Cervical Cancer Screening Between Age 66–68 Years by Prior Screening History

	All study women Screening between age 66–68 years			Sensitivity analysis (Exclude women tests in 2 years before age 66 years) Screening between age 66–68 years		
Prior screening history	**No[a]**	**Yes[a]**	**Total[b]**	**No[a]**	**Yes[a]**	**Total[b]**
Adequate prior screening[c]	10,156 (90.0)	1,131 (10.1)	11,287 (76)	5,411 (89.9)	606 (10.1)	6,017 (67.3)
Inadequate prior screening[c]						
Abnormal results from most recent test	72 (28.9)	177 (71.1)	249 (1.7)	41 (69.5)	18 (30.5)	59 (0.7)
Abnormal results, not from most recent test	272 (65.2)	145 (34.8)	417 (2.8)	148 (84.6)	27 (15.4)	175 (2.0)
No test done	1,296 (97.4)	34 (2.6)	1,330 (9.0)	1,296 (97.4)	34 (2.6)	1,330 (14.9)
Normal results but insufficient screening	1,416 (94.7)	79 (5.3)	1,495 (10.1)	1,279 (94.4)	76 (5.6)	1,355 (15.2)
Total	13,212	1,566	14,778	8,175	761	8,936

Note: [a]Row percent for "No" and "Yes" columns.
[b]Column percent.
[c]Women who met the following criteria were categorized as having adequate prior screening: 3 consecutive negative cytology results or 2 consecutive negative co-test results between age 56–65 years, with the most recent test occurring within the past 5 years. All other women were categorized as having inadequate prior screening.

findings remained the same for most women except for those with prior abnormal results (Table 2). When the authors further explored by separately examining women with abnormal results from the most recent screening that was within or not within 2 years before age 66 years, the proportions screened between age 66 and 68 years were 84% and 31%, respectively (data not shown). For women with prior abnormal test results but not from the most recent screening, the proportions screened were 49% and 15% if the abnormal test was done within or not within 2 years before age 66 years (data not shown).

In multivariable analysis of women with adequate prior screening, women who had more frequent office visits (RR=1.12, 95% CI=1.08, 1.17 for every 10 additional office visits; Table 3) were more likely to continue screening after age 65 years. By contrast, those with a female versus male primary care physician (RR=0.82, 95% CI=0.73, 0.93), recently hospitalized (RR=0.77, 95% CI=0.62, 0.96), and with multiple co-morbidities (RR=0.74, 95% CI=0.62, 0.88) were less likely to receive screening after age 65 years.

Among women with inadequate prior screening history, screening history subcategories were the strongest predictor for being potentially underscreened after age 65 years. Those with no prior screening (RR=3.54, 95% CI=2.88, 4.36; Table 4) or those with normal results but inadequate screening (3.44, 95% CI=2.80, 4.23) were more than 3 times as likely to not receive screening after age 65 years than those who had abnormal results from the most recent screening. Those who had a prior abnormal result but not from the most recent screening also had more than 2 times the risk of not receiving screening after age 65 years (RR=2.37, 95% CI=1.91, 2.94) compared with those who had abnormal results from the most recent screening. A history of multiple co-morbidities and black race were significantly associated with screening after age 65 years, although the magnitude of the differences was relatively small (RR=1.04 and 0.94, respectively).

Only 5 of 106 chart-reviewed women had chart notes documenting a history of cervical dysplasia treatment, although 2 had the treatment from >20 years ago.

DISCUSSION

In this study, approximately 24% of women reaching age 65 years did not have adequate prior screening per U.S. Preventive Service Task Force/American Cancer Society/American College of Obstetrics and Gynecology screening exit recommendations.[1,4] Further, most (88%) of the women without adequate prior screening were not screened during the study follow-up period after age 65 years. This proportion varies significantly depending on the pattern of the screening history, with continued screening most often observed for those who had an abnormal screening result within 2 years before age 66 years, and least often observed for those with no screening test between age 56 and 65 years. In addition, 10% of the women who had adequate prior screening received screening after age 65 years. These findings point to the need to monitor and understand screening practices in older women and develop interventions to help minimize underutilization and overutilization of cervical cancer screening in this population.

Table 3. Bivariate and Multivariable Analysis for Continued Screening Between Age 66–68 Years Among Those With Adequate Prior Screening

Characteristics	Crude RR (95% CI)	*p*-value	Adjusted RR[a] (95% CI)	*p*-value
Race/ethnicity[b]				
White, non-Hispanic	ref		ref	
Black, non-Hispanic	1.03 (0.85, 1.25)	0.78	1.11 (0.91, 1.36)	0.28
Hispanic	0.84 (0.71, 0.98)	0.03	0.92 (0.78, 1.09)	0.34
Asian	0.85 (0.70, 1.02)	0.08	0.88 (0.73, 1.06)	0.18
Other	0.64 (0.39, 1.05)	0.08	0.69 (0.42, 1.12)	0.14
Median household income by Census block[c]				
≤$45,000	ref		ref	
$45,001–$80,000	1.03 (0.88, 1.22)	0.67	1.00 (0.83, 1.19)	0.97
>$80,000	1.20 (1.02, 1.41)	0.03	1.12 (0.91, 1.38)	0.28
Percent of adults with high school diploma by Census block, per 10% increase	1.06 (1.01, 1.11)	0.01	1.03 (0.97, 1.09)	0.38
Influenza vaccination[d]	0.96 (0.86, 1.09)	0.55	0.94 (0.83, 1.06)	0.29
Number of office visits,[d] per 10-visit increase	1.10 (1.06, 1.14)	**<0.01**	1.12 (1.08, 1.17)	**<0.01**
Any ER visit[d]	1.00 (0.93, 1.07)	0.94	1.06 (0.97, 1.14)	0.18
Any hospitalization[d]	0.84 (0.70, 1.02)	0.07	0.77 (0.61, 0.96)	0.02
Charlson's co-morbidity index[e]				
0	ref		ref	
1	1.05 (0.92, 1.20)	0.45	1.03 (0.90, 1.17)	0.69
≥2	0.76 (0.65, 0.90)	**<0.01**	0.75 (0.63, 0.89)	**<0.01**
Having a female PCP	0.80 (0.71, 0.90)	**<0.01**	0.82 (0.73, 0.93)	**<0.01**
Woman's PCP by years of practice, per 10-year increase	1.11 (1.04, 1.19)	**<0.01**	1.08 (0.96, 1.21)	0.22
Woman's PCP by age, per 10-year increase	1.11 (1.04, 1.19)	**<0.01**	1.01 (0.89, 1.15)	0.88

Note: Boldface indicates statistical significance ($p<0.05$). Women who met the following criteria were categorized as having adequate prior screening: 3 consecutive negative cytology results or 2 consecutive negative co-test results between age 56–65 years, with the most recent test occurring within the past 5 years.
[a]Adjusted for all the variables listed in this table.
[b]Those with missing race/ethnicity data (<2%) were excluded from the regression analyses.
[c]Cut-offs were chosen as they approximated the 25th and 75th percentile in the study population.
[d]Within 12 months before age 66 years.
[e]Cut-offs were chosen given the skewed distribution of Charlson's index in the study population and to compare those with no co-morbidity, single co-morbidity, and multiple co-morbidities.
ER, emergency room; PCP, primary care provider.

To the authors' knowledge, this study is among the first to provide a systematic examination and evidence of a significant gap in guideline adherence of cervical cancer screening in women older than age 65 years. White and colleagues[12] examined data from the 2013 and 2015 National Health Interview Surveys and reported that the proportion of women with a cervix not recently screened increased with age, from 18% of women aged 61–65 years to 24% of women aged 66–70 years not screened in the past 5 years. Rosenblatt et al.[16] found a history of Pap test 2–7 years prior protective for cervical cancer in women aged ≥65 years, providing evidence for the benefit of screening beyond age 65 years. Dinkelspiel and colleagues[17] evaluated cervical cancer cases diagnosed in women aged >65 years at KP Northern California and concluded that most of these cancers occurred in those who did not meet the screening cessation criteria. Taken together, these studies emphasize the importance of continuous screening in older women who do not meet the screening exit criteria.[1,4]

This study found that 10% of the women with adequate prior screening history continue to receive screening after age 65 years. Chart review of a random subset revealed little documentation for surveillance rationales, suggesting that some of this could represent potential overscreening. Royce et al.[18] had reported overscreening in older women; for example, 26% of older women at high risk for 5-year mortality reported receiving cervical cancer screening in the past 3 years. Studies have shown that some older patients view cancer screening as a routine part of their health care and may not be ready to stop screening.[19] That said, in a study by Sawaya and colleagues,[20] 68% of older women said they would end

Table 4. Bivariate and Multivariable Analyses for Lack of Screening Between Age 66–68 Years Among Those With Inadequate Prior Screening

Characteristics	Crude RR (95% CI)	*p*-value	Adjusted RR[a] (95% CI)	*p*-value
Screening history				
Abnormal result (most recent)	ref		ref	
Abnormal result (not most recent)	2.26 (1.84, 2.76)	**<0.01**	2.37 (1.91, 2.94)	**<0.01**
Normal results with insufficient screening	3.28 (2.70, 3.98)	**<0.01**	3.44 (2.80, 4.23)	**<0.01**
No test done	3.37 (2.78, 4.09)	**<0.01**	3.54 (2.88, 4.36)	**<0.01**
Race/ethnicity[b]				
White, Non-Hispanic	ref		ref	
Black, Non-Hispanic	0.90 (0.86, 0.95)	**<0.01**	0.94 (0.91, 0.98)	**<0.01**
Hispanic	0.98 (0.94, 1.02)	0.32	1.01 (0.98, 1.04)	0.60
Asian	0.98 (0.93, 1.02)	0.30	0.99 (0.96, 1.03)	0.76
Other	1.05 (1.00, 1.12)	0.07	1.01 (0.95, 1.07)	0.73
Median household income (Census block)[c]				
≤$45,000	ref		ref	
$45,001–$80,000	1.01 (0.97, 1.04)	0.70	1.01 (0.98, 1.04)	0.70
>$80,001	0.97 (0.94, 1.01)	0.16	1.00 (0.96, 1.04)	1.00
Percent of adults with high school diploma by Census block, per 10% increase	0.99 (0.98, 1.00)	0.06	0.99 (0.98, 1.00)	0.17
Influenza vaccination[d]	0.95 (0.92, 0.97)	**<0.01**	0.98 (0.96, 1.01)	0.13
Number of office visits,[d] per 10 visits increase	0.97 (0.96, 0.99)	**<0.01**	0.99 (0.98, 1.01)	0.30
Any ER visit[d]	0.99 (0.97, 1.01)	0.27	1.00 (0.98, 1.02)	0.68
Any hospitalization[d]	1.00 (0.97, 1.02)	0.82	1.00 (0.97, 1.04)	0.78
Charlson's co-morbidity index[e]				
0	ref		ref	
1	0.97 (0.94, 1.00)	0.06	1.02 (0.99, 1.04)	0.27
≥2	0.98 (0.95, 1.02)	0.35	1.04 (1.00, 1.07)	0.03
Having a female PCP	0.98 (0.95, 1.00)	0.06	0.99 (0.97, 1.01)	0.28
Woman's PCP by years of practice, per 10-year increase	0.99 (0.97, 1.00)	0.10	1.00 (0.98, 1.02)	0.84
Woman's PCP by age, per 10-year increase	1.00 (0.98, 1.01)	0.66	0.99 (0.97, 1.01)	0.30

Note: Boldface indicates statistical significance ($p<0.05$). Women who did not met the following criteria were categorized as having inadequate prior screening: 3 consecutive negative cytology results or 2 consecutive negative co-test results between age 56–65 years, with the most recent test occurring within the past 5 years.
[a]Adjusted for all the variables listed in this table.
[b]Those with missing race/ethnicity data (<2%) were excluded from the regression analyses.
[c]Cut-offs were chosen as they approximated the 25th and 75th percentile in the study population.
[d]Within 12 months before age 66 years.
[e]Cut-offs were chosen given the skewed distribution of Charlson's index in the study population and to compare those with no co-morbidity, single co-morbidity, and multiple co-morbidities.
ER, emergency room; PCP, primary care provider.

screening if recommended by their physician. Concerns related to the stopping age for screening may also contribute to overscreening in women. To this end, the current guidelines for existing cervical cancer screening at age 65 years have been questioned.[21] Concerns include the long average life expectancy (20.5 years) at age 65 years for U.S. women and emerging data supporting the potential benefits of screening beyond age 65 years.[16,21,22] Castañón et al.[23] also reported on the weakening protective association over time associated with adequate negative screening at age 65 years. Additional evidence, including better incorporation of benefits and harms from women's perception, are needed to further inform this debate.

The definition of adequate prior screening in current clinical guidelines requires a long patient history and may pose challenges for physicians to determine the adequacy of prior screening at age 65 years, especially considering that patient self-report of cervical cancer screening can be unreliable.[24,25] In situations where the woman has not been with the same provider for 10 years and the adequacy of past screening is unknown, screening may be clinically indicated. Even when complete patient history is available in the health system (as in this study), decision support tools that will automatically generate the status of a woman's prior screening history will be greatly beneficial. This study indirectly supports this idea, as considerably more women with an

abnormal screening result within 2 years before age 66 years continued to receive screening, compared with women whose abnormal screening result was more than 2 years before turning age 66 years, suggesting a role of recall or physician documentation and the need for better automation tools.

In women with adequate prior screening, increased encounters with the healthcare system and having male (versus female) primary care providers were associated with continued screening after age 65 years. It has been reported that female providers are more attentive to preventive care;[26] thus, it is possible that female providers are also more likely to deliver prevention guideline concordant care or are more comfortable discussing screening exit. Multiple co-morbidities, as expected, were associated with a lower likelihood of receiving screening after age 65 years (in both women with and without adequate prior screening). This is consistent with the literature that those with co-morbidities were in general less likely to attend to their preventive care need.[27–29] However, stopping screening in those with a high co-morbidity burden and thus potentially a shorter life expectancy may be appropriate and should not be automatically considered underscreening among women with inadequate prior screening.[6]

Limitations

There are several limitations that should be considered when interpreting the results of this study. First, the follow-up length only allows the determination of the screening status in 1 screening cycle. Second, during the study period, KPSC transitioned from 3-year to 5-year co-testing intervals. Yet the findings remain the same in the sensitivity analysis restricted to women with at least 5 years of follow-up since their last test. Third, complete data may not be available on women's history of hysterectomy before their KPSC enrollment, which may partially explain the 9% of women who did not have any screening test within 10 years before age 66 years. Fourth, Data on the complete history of previous cervical lesions and diethylstilbestrol exposure were also not available, which are indications for increased risk of cervical cancer. Fifth, this study included only women with 13 years of complete membership history (i.e., about 50% of all women turning age 66 years). These results thus may represent a better case scenario, as women with a long membership history may have different practices when it comes to preventive care. Further, findings may not be generalizable to women who had limited or no health insurance before age 65 years. It should also be noted that this study focused on adherence to screening guidelines and did not include the examination of adherence to surveillance guidelines for women who have had the diagnosis of cervical dysplasia after colposcopy.[14] Finally, although chart review was performed to explore women's history of cervical intraepithelial neoplasia Grade 2, physicians may not routinely document it at the screening visits.

CONCLUSIONS

This study identifies a considerable proportion of women did not have an adequate prior screening history by age 65 years and should continue to receive screening after age 65 years. Yet most of these women did not receive screening during the study follow-up period after age 65 years. Given that cervical cancer continues to be diagnosed in older age, it is imperative that at-risk women continue to be screened after age 65 years. Electronic medical record–based decision support tools that summarize a woman's prior screening history may provide critical help for clinicians to follow guideline recommendations. Qualitative studies are needed to further understand barriers and facilitators of guideline concordant screening practices in older women.

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SUPPLEMENTAL MATERIAL

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