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Excess Cost of Cervical Cancer Screening Beyond Recommended Screening Ages or After Hysterectomy in a Single Institution

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Abstract

Objective—The aim of the study was to estimate the excess cost of guideline nonadherent cervical cancer screening in women beyond the recommended screening ages or posthysterectomy in a single healthcare system.

Materials and Methods—All Pap tests performed between September 1, 2012, and August 31, 2014, in women younger than 21 years, older than 65 years, or after hysterectomy, were coded as guideline adherent or nonadherent per the 2012 America Society of Colposcopy and Clinical Pathology guidelines. We assumed management of abnormal results per the 2013 America Society of Colposcopy and Clinical Pathology management guidelines. Costs were obtained from a literature review and Center for Medicare and Medicaid Services data and applied to nonadherent screening and subsequent diagnostic tests.

Results—During this period, 1,398 guideline nonadherent Pap tests were performed (257 in women <21 years, 536 in women >65 years, and 605 after hysterectomy), with 88 abnormal results: 35 (13.5%) in women younger than 21 years, 14 (2.6%) in women older than 65 years, and 39 (6.5%) in women after hysterectomy. The excess cost for initial screening, diagnostic tests, and follow-up was US $35,337 for 2 years in women younger than 21 years, US $54,378 for 5 years in women older than 65 years, and US $77,340 for 5 years in women after hysterectomy, resulting in

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a total excess cost of US $166,100 for 5 years. Of the 1,398 women who underwent guideline nonadherent screening, there were only 2 (0.1%) diagnoses of high-grade dysplasia (VaIN3).

Conclusions—Guideline nonadherent cervical cancer screening in women beyond the recommended screening ages and posthysterectomy resulted in costs exceeding US $160,000 for screening, diagnostic tests, and follow-up with minimal improvement in detection of high-grade dysplasia.

Keywords

cervical cancer screening; cost; guideline adherence; posthysterectomy

The United States spends more than twice as much on healthcare as other industrialized nations but has similar and some-times worse health outcomes.[1] This is due at least in part to the use of tests and procedures, which do not decrease disease development, morbidity, or mortality. Current United States cervical cancer screening guidelines recommend against cervical cancer screening in women at low risk of developing cervical cancer, including women younger than 21 years, older than 65 years with a history of normal results, or after hysterectomy.[2–5] However, multiple studies have demonstrated that screening continues in these populations despite minimal benefit and even possible harm.[6–9] We previously performed a cross-sectional review of cervical cancer screening in women younger than 21 years, older than 65 years, or after hysterectomy within Fairview Health Systems and University of Minnesota Physicians, a large nonprofit health center in Minnesota. Academic and community clinics in urban, suburban, and rural locations comprise the health system, which partners with 2,500 physicians and includes greater than 56 primary care clinics.[10] Of 3,920 individual women who had at least 1 Pap test between September 2012 and August 2014, 65% of the Pap tests were indicated for the following reasons: cancer surveillance (30%), supracervical hysterectomy (22%), inadequate previous screening (18%), follow-up of a previous abnormal Pap test or high-grade dysplasia (16%), within 6 months of age 21 years (9%), evaluation of postmenopausal bleeding or other abnormal exam finding (5%), immunocompromise (1%), and diethylstilbestrol exposure or other indication (<1%). The remaining 35% of Pap tests (N = 1,398) performed in these screening groups were not indicated per the United States 2012 cervical cancer screening guidelines[11] and form the population for this study. Our previous study looked only at whether the Pap test was indicated and did not examine test outcomes. This study sought to understand the impact of guideline nonadherent testing, including the number of additional diagnostic tests performed to evaluate abnormal screening results, the excess costs associated with guideline nonadherent testing, and the number of diagnoses of high-grade dysplasia, which may have been missed by adhering to the national cervical cancer screening guidelines. The primary objective of this study was to determine the excess costs of performing cervical cancer screening in women for whom cervical cancer screening is not indicated (women aged <21 or >65 years or after hysterectomy) within Fairview Health System and University of Minnesota Physicians. A secondary objective was to determine the incidence of high-grade dysplasia in this patient population.

MATERIALS AND METHODS

University of Minnesota Institutional Review Board approval was obtained for this study. Data collection and designation of guideline nonadherent Pap tests in women for whom testing was not indicated have been previously described.[11] In brief, Pap tests performed in women younger than 21 or older than 65 years of age or after hysterectomy between September 1, 2012, and August 31, 2014, were identified through a query of the electronic health record. For women who received more than 1 Pap test during this period, only the first Pap test was included in the analysis. All charts were manually reviewed, and Pap tests were designated as guideline adherent or nonadherent per the 2012 National Cervical Cancer Screening Guidelines.[5] The Pap tests, which were categorized as nonadherent, formed the group for this study.

The results for the index Pap tests and associated human papillomavirus (HPV) tests, if performed, were abstracted. For all patients, subsequent Pap and HPV tests and biopsy results were reviewed and recorded. For patients older than 65 years or after hysterectomy with normal results, we assumed that no additional screening was performed in the future and for patients older than 21 years with normal results we assumed that no screening was performed until the patient was 21 years. For patients with abnormal test results, we assumed that diagnostic evaluation was performed per the 2013 America Society of Colposcopy and Clinical Pathology management guidelines.[12] Treatment of high-grade dysplasia was considered an indicated cost; thus, the cost of high-grade dysplasia treatment was not included in this study.

To obtain more generalized estimates of cost, cost data were obtained from a review of the literature[13–16] and 2016 Center for Medicare and Medicaid Services data.[17,18] Estimated costs included the costs of procedures, laboratory costs, and costs of office visits (see Table 1). During this period, most providers in our system were performing Pap tests with reflex HPV testing rather than Pap and HPV co-testing, so the initial cost of testing included the Pap test only. For diagnoses in which the diagnostic strategy was stratified by HPV status, the cost of HPV testing was added for the proportion of patients in our study who underwent reflex testing, and the cost of subsequent tests was based on the proportion of patients in our data set undergoing each diagnostic strategy. For patients undergoing colposcopy, we assumed 1 biopsy was taken. We assumed that all patients received follow-up Pap and HPV co-testing as indicated by the management guidelines and included these costs in the analyses.

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RESULTS

Between September 1, 2012, and August 31, 2014, a total of 3,920 women younger than age 21 years, older than age 65 years, or after hysterectomy underwent at least 1 screening Pap test. Using conservative criteria, 1,398 tests (35.7%) were not indicated per the cervical cancer screening guidelines. These 1,398 screening Pap tests formed the group for this study.

In women younger than 21 years, 257 (50.5%, 95% CI = 46.1%−54.9%) of the 509 Pap tests performed were guideline nonadherent when Pap tests performed within 6 months of the patient's 21st birthday were coded as indicated. Of these 257 Pap tests, there were 35 (13.6%) abnormal results (see Table 2). Assuming a cost for the index cytology and office visit of US $92, the total cost for the initial Pap tests in this group was US $23,828. For the 3 patients with an atypical squamous cells, cannot rule-out high-grade lesion (ASC-H) result, an additional US $525 was spent per patient for diagnostic tests assuming 1 biopsy was taken during the colposcopy, for a total of US $1,575. For the every 6-month colposcopy and cytology follow-up for 2 years, assuming a single biopsy was taken 50% of the time, the additional follow-up cost was US $6,354 for 24 months. For the 9 patients with low-grade squamous intraepithelial lesion (LSIL) result, the total cost of annual follow-up cytology was US $1,656 for 24 months. For the patients with an atypical squamous cells of undetermined significance (ASCUS) result, 19 had reflex HPV testing, which added US $912. For those who were HPV-negative, routine screening was recommended, and no additional cost was added. For the 7 patients with an HPV-positive result and the 4 patients whose HPV status was unknown, the additional cost of annual cytology for 2 years was US $1,012. No high-grade dysplasia was diagnosed in this group, but approximately US $137 was spent per guideline nonadherent Pap test in women younger than 21 years for a total additional cost of US $35,337.

In women older than 65 years, 536 (40.4%, 95% CI = 37.7%–43.1%) of the 1,327 Pap tests were not indicated. Of these 536 Pap tests, there were 14 (2.6%) abnormal results; in addition, 10 (1.9%) had unsatisfactory results, which led to repeat Pap tests (see Table 3). The cost for the initial 536 Pap tests was US $49,312. For the 2 patients who had ASC-H results, cost of the additional office visit with colposcopy and 1 biopsy was US $1,050. The cost of follow-up co-testing at 12 and 24 months and then 3 years was US $840. For the 12 patients with ASCUS test results, the cost of reflex HPV testing was US $576. Because all patients were HPV-negative, only the cost of co-testing in 3 years was added with a total cost of US $1,680. For the 10 patients who had unsatisfactory results, the additional cost of another office visit and repeat Pap test was US $920. No high-grade dysplasia was diagnosed in the older than 65-year-old age group through 2016, but the guideline nonadherent screening and subsequent diagnostic and follow-up tests cost a total of US $54,378, or approximately US $101 per guideline nonadherent Pap test in women older than 65 years.

In the posthysterectomy group, 605 (29.0%, 95% CI = 27.1%–31.0%) of the 2,084 Pap tests were nonindicated. Of these 605 Pap tests, there were 39 (6.4%) abnormal results; in addition, there were 13 (2.1%) with unsatisfactory results, which led to repeat Pap tests (see Table 4). The cost for the initial 605 Pap tests was US $55,660. For the patient who had an

ASC-H result, the cost of the additional office visit with colposcopy and 1 biopsy was US $525. The cost of follow-up co-testing at 12 and 24 months and then 3 years was US $420. For the 12 patients with LSIL test results, the cost of reflex HPV testing for 7 of them was US $336. For the 8 patients who had LSIL Pap test results, HPV-positive or HPV-unknown, the cost of diagnostic colposcopy assuming 1 biopsy was US $4,200 with an additional US $3,360 spent for 5 years for follow-up co-testing at 12 months, 24 months, and 3 years. For the 26 patients with an ASCUS Pap test result, an additional US $1,248 was spent on reflex HPV testing. For the 7 who tested HPV-positive, an additional US $3,675 was spent for diagnostic colposcopy assuming 1 biopsy (total US $4,011 including the cost of reflex HPV testing), and US $2,940 was spent for the next 5 years for follow-up co-testing at 12 months, 24 months, and 3 years. For the 19 patients who had an ASCUS Pap test result, HPV-negative, an additional US $2,660 was spent for follow-up co-testing in 3 years. For the 13 patients with unsatisfactory Pap tests, the test was repeated for an additional cost of US $1,196. In the posthysterectomy group, there were 2 diagnoses of high-grade dysplasia. The first patient had an ASC-H Pap test result, and the second patient had an HPV-positive ASCUS Pap test result; both were subsequently diagnosed with vaginal intraeptihelial neoplasia 3. Both received treatment for their dysplasia and were without evidence of disease at last follow-up in 2016. There were 605 guideline nonadherent Pap tests performed with 2 diagnoses of high-grade dysplasia, resulting in an incidence of 0.3%, and excess cost of US $77,340 in the posthysterectomy group. In this group, approximately US $128 was spent per guideline nonadherent Pap test or US $38,670 per posthysterectomy dysplasia diagnosis.

DISCUSSION

The estimated total excess cost in the Fairview Health System and University of Minnesota Physicians for guideline nonadherent cervical/vaginal cancer screening and diagnostic tests in women outside the screening age boundaries, or posthysterectomy was US $166,110 for 5 years, with the majority (75%) of the cost due to the index Pap tests. For each Pap test among women who did not meet criteria for screening, approximately US $119 was spent when cost of the index Pap test as well as indicated diagnostic tests were included. For each additional diagnosis of high-grade dysplasia, an additional 617 screening Pap tests were performed with 43 false-positive results and an excess cost of US $83,055. Other studies have supported our finding that approximately one-third to one-half of women beyond the recommended screening ages or posthysterectomy continue to undergo guideline nonadherent cervical cancer screening throughout the country.[6,7] Therefore, when this excess cost is multiplied among the hundreds of healthcare systems and networks across the United States, excess cervical cancer screening results in millions of dollars spent with minimal reduction in cervical or vaginal cancer incidence. Thus, decreasing guideline nonadherent cervical cancer screening is 1 example of a way the United States could decrease healthcare expenditures without negatively impacting the health of the population.

This study estimated the costs directly associated with cervical cancer screening and diagnostic tests in low-risk populations but does not take into account costs associated with complications from the diagnostic tests, time taken off from work for the excess tests, or the anxiety that is associated with abnormal test results. In a prospective study from the

Netherlands, 40% of women undergoing a screening Pap test reported lower abdominal pain, vaginal bleeding, discharge, urinary discomfort, a sick feeling, dizziness, and/or painful sexual activity for 1 to 7 days after the test; of these, 12% rated their symptoms as fairly or very painful.[19] Although not all of these symptoms can be explained by physical effects of the test itself, symptoms could have been initiated or augmented by a psychosomatic reaction, because 25% of participants in this study reported that the screening procedure was fairly or very stressful, with 33% of them still reporting feeling stress after receiving a negative test result. For patients with abnormal results, the adverse effects are even greater. In a prospective study of women undergoing biopsy to evaluate an abnormal screening test, 53% reported pain, 79% reported bleeding and 46% reported discharge. Anxiety was even higher with an abnormal test, and for women with borderline or mildly dysplastic results for which no treatment was recommended, anxiety levels remained elevated for 6 to 24 months after colposcopy.[19,20] Although these adverse effects seem minor in comparison with cancer, cervical cancer incidence and mortality in the Netherlands are similar to that of the United States with half as much screening.[21,22]

Although the diagnosis of high-grade vaginal dysplasia in 2 low-risk patients after hysterectomy is concerning, this diagnosis does not carry the same risk of progression to cancer as does high-grade cervical dysplasia. In a recent literature review, the estimated risk of progression from vaginal intraeptihelial neoplasia to vaginal cancer was 0% to 9%, compared with up to a 30% risk of progression from cervical intraepithelial neoplasia to cancer.[23] Although treatment of vaginal dysplasia with excision, CO_2 laser ablation, or topical medication is recommended, the rate of progression to cancer is so low that the benefit of treatment is unclear.

The strengths of our study include the manual chart review, which ensured that patients included in this study had no other risk factors for which screening would have been indicated despite age or surgical history. For the index Pap tests and other tests performed in our system, we were able to abstract the results, so numbers of abnormal tests during the period are a true cross-sectional representation and not estimates based on national rates of abnormal cytology or dysplasia. However, to increase generalizability, costs applied to this study come from publically available data and are not specific to our hospital system. The limitations of our study include the fact that it was performed in a single health system. Although the health system includes both academic and community clinics in urban, suburban, and rural locations, practice patterns within the health system may be different from other health systems and results may not be generalizable. This is also a retrospective study, and we were limited to the data available in the local electronic health record; despite a thorough manual chart review, it is possible that patients had testing outside of our system for which results were not available or referenced in clinician notes. Access to additional test results would have resulted in an increased excess cost, as all Pap tests performed patients older than 65 years for whom we did not have 3 negative Pap test results or 2 negative HPV test results within 10 years of age 65 years in our system were coded as guideline adherent in the initial study and thus were not included in this study. We assumed that all patients in this cohort with a negative index Pap test stopped screening after that test, whereas in reality, many of these women continued screening per their request or healthcare provider practice. We also assumed that all women with abnormal test results received diagnostic and follow-

up testing per the America Society of Colposcopy and Clinical Pathology guidelines to provide a simple and conservative estimate of costs associated with excess cervical cancer screening. Because the management guidelines are complex with the potential to partially but not completely follow the guidelines, we need to evaluate provider adherence to the management guidelines in a future study. Lastly, we had limited follow-up of these patients because the index Pap tests were performed between 2012 and 2014, and follow-up data were reviewed through 2016.

CONCLUSIONS

Our study provides a conservative estimate of the excess costs associated with screening in low-risk women younger than 21 or older than 65 years, or after hysterectomy. Given the limited benefit of screening in low-risk women and the costs and potential harms associated with overscreening, interventions are needed to improve adherence to the cervical cancer screening guidelines.

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TABLE 1.

Cost Estimates

Procedure/test	Estimated cost, US
Office visit (screening)	$55
Office visit (diagnostic)	$65
Pap test	$37
HPV test	$49
Colposcopy	$395
Biopsy (single)	$65

HPV indicates human papillomavirus.

TABLE 2.

Costs of Nonindicated Screening and Follow-Up Tests in Women <21 Years (n = 257)

Screening result'	*n* (%)	Diagnostic test Follow-up test costs, US costs, US	
Initial screening	257	$23,828	NA
ASC-H	3(1.2)	$1,575	$6,354
LSIL	9(3.5)	$0	$1,656
ASCUS, hrHPV−	12(4.5)	$576[a]	$0
ASCUS, hrHPV+	7 (2.7)	$336[a]	$644
ASCUS, hrHPV NOS	4(1.6)	$0	$368
		Total cost: $35,337 for 2 y	

[a]Cost for reflex hrHPV testing.

ASC-H indicates atypical squamous cells, cannot rule-out high-grade; LSIL, low-grade squamous intraepithelial lesion; ASCUS, atypical squamous cells of undetermined significance; hrHPV, high-risk human papillomavirus; NA, not available; NOS, not done.

TABLE 3.

Costs of Nonindicated Screening and Follow-Up Tests in Women >65 Years (n = 536)

Screening result	*n* (%)	Diagnostic test costs, US	Follow-up test costs, US
Initial screening	536	$49,312	NA
ASC-H	2 (0.4)	$1,050[a]	$840
ASCUS, hrHPV−	12(2.2)	$576[b]	$1,680
Unsatisfactory	10(1.9)	$920[c]	NA
		Total cost: US $54,378 for 5 y	

[a]Cost of colposcopy + 1 biopsy. bCost for reflex hrHPV testing.

[b]Cost for reflex hrHPV testing + colposcopy + 1 biopsy. dCost for colposcopy + 1 biopsy.

[c]Cost of repeat screening Pap test.

ASC-H indicates atypical squamous cells, cannot rule-out high-grade; ASCUS, atypical squamous cells of undetermined significance; hrHPV, high-risk human papillomavirus; LSIL, low-grade squamous intraepithelial lesion; NA, not available; NOS, not done.

TABLE 4.

Costs of Nonindicated Screening and Follow-Up Tests in Women After Hysterectomy (n = 605)

Screening result	*n* (%)	Diagnostic test costs, US	Follow-up test costs, US
Initial screening	605	$55,660	NA
ASC-H	1 (0.2)	$525[a]	$420
LSIL, hrHPV−	4 (0.7)	$192[b]	$1,120
LSIL, hrHPV+	3 (0.5)	$1,719[c]	$1,260
LSIL, hrHPV NOS	5 (0.8)	$2,625[d]	$2,100
ASCUS, hrHPV−	19(3.1)	$912[b]	$2,660
ASCUS, hrHPV+	7(1.2)	$4,011[c]	$2,940
Unsatisfactory	13 (2.1)	$1,196[e]	NA
		Total cost: US $77,340 for 5 y	

[a]Cost of colposcopy + 1 biopsy. bCost for reflex hrHPV testing.

[b]Cost for reflex hrHPV testing.

[c]Cost for reflex hrHPV testing + colposcopy + 1 biopsy.

[d]Cost for colposcopy + 1 biopsy.

[e]Cost of repeat screening Pap test.

ASC-H indicates atypical squamous cells, cannot rule-out high-grade; ASCUS, atypical squamous cells of undetermined significance; hrHPV, high-risk human papillomavirus; LSIL, low-grade squamous intraepithelial lesion; NA, not available; NOS, not done.