

Pap Screening in a U.S. Health Plan

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Abstract

The U.S. Preventive Services Task Force recommends cervical cancer screening begin with the onset of sexual activity and be repeated at least every 3 years until age 65. Previous studies examining the annual utilization and frequency of Pap screening have relied on patient self-report, found to be less reliable than medical records and administrative data. We estimate the age-specific rate and frequency of Pap screening in a U.S. health plan using 1998–2002 administrative data on 150,052 female enrollees within the Kaiser Permanente Northwest health plan, Portland, OR. We analyze the age-specific rate of cervical and vaginal Pap screening and age-specific proportion of routinely screened women receiving cervical screening at various yearly intervals. Of the enrolled women, 31.2% received a Pap smear in 1998, with utilization highest for ages 25–29 (62.4%). Among routinely screened women, 36% were

estimated to receive annual cervical smears, *versus* 22% biennial, 13% triennial, and 29% less frequent screening. Less frequent screening was observed with increasing age. These are the first age-specific estimates of Pap screening frequency and annual utilization in a general healthcare setting, derived from administrative data, rather than self-report. Overall Pap utilization was lower than found in national surveys based on self-report. Despite limited evidence of benefit from more frequent screening, a substantially higher proportion of women was found to receive annual rather than either biennial or triennial screening. Sporadic screening was also more prevalent than expected based on prior self-reported data. Further opportunities exist for improving screening adherence, even within traditionally less vulnerable populations. (Cancer Epidemiol Biomarkers Prev 2004;13(3):355–360)

Introduction

Cervical cancer is caused by infection with the human papillomavirus (HPV), estimated to be the most commonly occurring sexually transmitted infection in the United States (1–4). It has been estimated that each year, 50 million Pap smears are performed in the U.S. for the purposes of detecting cervical cancer and its precursors (5). Eighty percent of U.S. women report that they have received a Pap smear within the past 3 years (6).

These and other broad population-based measures of the rate and frequency of Pap screening have largely been based on self-reported behavior (5–9). Previous studies have shown that screening rates estimated through self-report substantially exceed those based on observed patterns of utilization (10–14). For instance, comparisons with medical records revealed that reliance on self-report overestimated the proportion of women receiving a Pap smear within the previous 1 and 2 years, respectively, by 35% in a Connecticut inner city health clinic (10), and 25% in a private health maintenance organization (HMO) (11).

In this paper, we describe the age-specific rate and frequency of Pap screening in a private U.S. health plan using patient administrative data. Few previous studies

have reported these measures within a broad general healthcare setting using validated data on utilization. This information is especially suited to understanding current practice patterns, the economic burden of cervical screening, and the potential health and economic impact of emerging technologies and guidelines (*e.g.*, new screening techniques, human papillomavirus vaccines, national screening recommendations) (15–18). Age-specific estimates are particularly needed to construct and validate mathematical and epidemiological models of Pap screening (15, 19).

Materials and Methods

Data Source. Inpatient and outpatient administrative data were obtained for enrollees of the Kaiser Permanente Northwest (KPNW) health plan for the years 1997–2002. Study protocols were approved by the institutional review boards of KPNW and the University of Wisconsin-Madison. KPNW is a not-for-profit group model HMO serving the greater Portland, OR region with a total enrolled population of 449,633 as of April 2000. The KPNW population is ~90% Caucasian, with a minority composition of Asian (2.6%), Hispanic (2.3%), African American (1.6%), Native American (0.8%), and other minority (1.1%) (20). KPNW enrollee demographic characteristics have been found to be similar to those of the general Portland area population (21).

Study Population and Selection Criteria. From a total 1998 KPNW female population of 227,915, we selected an eligible sample of 150,052 females with 2 years of

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continuous health insurance enrollment for 1997–1998 (Table 1). This continuous enrollment period was required to allow for an adequate window of observation for distinguishing between a routine cervical smear, and a follow-up smear for a prior abnormality.

Data for eligible women receiving a Pap smear in 1998 ($n = 48,112$) were selected via inpatient, outpatient, and cytology codes. A routine Pap smear was defined to occur at the first 1998 service date with a KPNW Pap cytology code, for which there was no evidence of follow-up for a prior Pap smear abnormality or related diagnosis of a cervical abnormality [International Classification of Diseases (ICD)-9 codes 180.0–180.9, 233.1, 622.1, 795.0, V10.41] during the previous 9 months. This minimum 9-month interval for distinguishing between routine and follow-up care is consistent with that used in prior studies (22, 23). An exception was made for pregnant women (ICD-9 codes 630–675, V22–V24) at prenatal and postpartum visits, for whom routine screening results were assessed at shorter intervals. All other Pap smears were considered as follow-up for a previously detected abnormality.

Data Reporting. Information on the presence of an intact cervix was not available for this cohort, because the sample size was too large to allow for a comprehensive chart review. On the basis of aggregate Health Employer Data and Information Set (HEDIS) measures, however, the rate of abdominal and vaginal hysterectomy among women ages 15–64 within KPNW (6.0/1000) is very similar to that estimated from nationally representative U.S. data from the National Hospital Discharge Survey (6.1/1000) (24–27). Given the similarity in estimates, and because the U.S. rates are stratified by 10-year age group, while the KPNW data are not, we have used the U.S. data to estimate the approximate age-specific prevalence of women with an intact cervix in the KPNW population (25–27).

From the eligible cohort with 2 years of continuous health plan enrollment ($n = 150,052$), age-specific estimates of the percent of women receiving routine and follow-up cervical screening during 1998 are expressed as a percentage of all females enrolled within the health plan during that year. We also report the proportion of females screened with vaginal smears only.

The frequency of routine cervical screening over the period 1998–2002 was analyzed using data from women

with a negative routine cervical smear in 1998. Analyses were limited to females with continuous health plan enrollment from 1997 to 2002 ($n = 103,476$). For the reporting of results, estimates of the time to a subsequent routine smear were rounded to the nearest whole year [*i.e.*, for a next routine cervical smear occurring 1, 2, 3, 4, or 5 or more years (if ever) in the future]. Thus, women with a subsequent routine cervical smear 0.5–1.5 years later were recorded as receiving an annual screen, 1.5–2.5 years later a biennial screen, etc.

The KPNW data set only allowed for the observation of 1997–2002 screening histories from among the group of women receiving a routine cervical smear in 1998. The number of women observed to have been screened at various intervals was therefore inflated by an appropriate factor in extrapolating from the subset of women screened in 1998 to the entire population of enrollees estimated to have received routine cervical screening during the 5-year observation window.

For instance, the number of women observed to have been screened exactly biennially beginning in 1998 (*i.e.*, with routine smears observed to occur exactly 2 years apart in 1998 and 2000) was inflated by a factor of 2. This inflation by a factor of 2 was designed to account for the expectation that only 50% of enrolled women who were in the midst of a 2-year screening interval during 1998 would actually be observed to have a Pap smear during 1998, as captured by our sample, with the other half screened only during 1997 and 1999, and therefore not observed among our sample of women screened during 1998. In similar fashion, the number of women receiving routine cervical screening exactly 3.2 years apart in time was inflated by a factor of 3.2. In essence, this inflation method allows one to use the observed screening intervals of a subset of women with baseline routine screening during a single year (1998) to estimate the distribution of screening intervals among women receiving cervical screening at any point over a 5-year period. Although a small proportion of females with an intact cervix will not receive any cervical screening within a 5-year period, as further described in the “Discussion” section, results derived using this method should reflect the relative distribution of screening intervals among the vast majority of enrollees at risk for cervical cancer.

Analyses were conducted from the perspective of a private health plan, with the scope limited to Pap smears occurring within Kaiser and those performed outside the plan for which health plan reimbursement was sought.

Statistical Analysis. Results are expressed as percentages. Overall estimates of Pap screening utilization were age-adjusted to the 1998 U.S. female population (28). Statistical significance was not evaluated because data were descriptive.

Results

The percentages of all enrolled women receiving any Pap screening, routine cervical screening, exclusively follow-up cervical screening, and vaginal screening only, during 1998, are presented by age group (Table 2), along with the estimated percentage of U.S. women with an intact cervix. Overall, 31.2% of females of any age received a Pap smear in 1998. The proportion of females with solely

Table 1. Age and insurance status of eligible cohort

Age	<i>n</i> (%)	Insurance status	<i>n</i> (%)
0–14	23,601 (15.7%)	Private	120,863 (80.6%)
15–29	23,527 (15.7%)	Medicare	23,271 (15.5%)
30–44	30,902 (20.6%)	Medicaid	4,683 (3.1%)
45–64	46,767 (31.1%)	Dual Medicare/ Medicaid	326 (0.2%)
65–84	22,018 (14.7%)	Unknown	909 (0.6%)
85+	3,237 (2.2%)		
Total	150,052 (100.0%)	Total	150,052 (100.0%)

Table 2. Percentage of enrolled women receiving Pap screening in 1998

Age	Enrollees	Routine cervical screening ^a	Follow-up cervical screening only ^a	Vaginal screening only	Any Pap screening	% of U.S. women with a cervix ^b
10–14	10,470	0.6%	0.0%	0.0%	0.6%	100.0%
15–19	11,684	21.0%	0.6%	0.1%	21.6%	99.8%
20–24	6,102	44.6%	2.1%	0.1%	46.8%	99.6%
25–29	5,741	60.4%	2.0%	0.1%	62.4%	98.0%
30–34	7,817	52.4%	1.5%	0.4%	54.3%	95.5%
35–39	10,411	46.0%	1.1%	1.1%	48.2%	91.1%
40–44	12,674	41.0%	0.9%	1.9%	43.8%	85.2%
45–49	14,221	39.1%	0.9%	3.4%	43.4%	79.7%
50–54	13,396	38.0%	0.9%	4.5%	43.5%	74.4%
55–59	10,492	33.2%	0.8%	5.6%	39.6%	71.1%
60–64	8,658	29.4%	0.5%	5.8%	35.7%	69.2%
65–69	6,605	26.2%	0.4%	5.1%	31.7%	67.3%
70–74	6,244	19.4%	0.3%	4.2%	23.9%	65.5%
75–79	5,374	12.9%	0.2%	3.9%	16.9%	64.1%
80–84	3,795	7.0%	0.2%	2.6%	9.7%	63.0%
85+	3,237	3.4%	0.0%	1.2%	4.6%	61.4%
Overall ^c	150,052	28.6%	0.8%	1.8%	31.2%	87.2%

^aCervical Pap rates are unadjusted for the age-specific proportion without a cervix.

^bEstimates based on data from the National Hospital Discharge survey.

^cOverall rates across all ages are age-adjusted to the 1998 U.S. female population.

vaginal smears (1.8%) was very low compared to those receiving cervical screening (29.4%). Screening utilization within the health plan nearly tripled between ages 15–19 and 25–29, where it peaked at 62.4%. Beyond this age, screening rates declined steadily, with fewer than 10% of women screened beyond age 80. The percentage of women receiving exclusively follow-up smears for a previous cervical abnormality was highest (2.1%) for the 20–24 age group, which was twice the rate for women in their 40s.

With U.S. data serving as a benchmark, the proportion of women with a cervix would be expected to decline progressively with age, with most hysterectomies occurring between age 35 and 59. This is consistent with the observed 5-fold increase in the percentage of Kaiser women exclusively receiving vaginal screening across these ages. Table 3 more accurately categorizes rapid changes in cervical screening utilization at younger ages. Screening for a small minority (0.7%) of adolescent girls begins at age 13, with the largest absolute increase in screening rates occurring between ages 16 and 18. There

Table 3. Percentage of young women receiving cervical screening in 1998^a

Age	Enrollees	Routine screening	Follow-up screening only	Total
12	2,071	0.0%	0.0%	0.0%
13	2,260	0.7%	0.0%	0.7%
14	2,166	2.2%	0.0%	2.2%
15	2,374	7.4%	0.1%	7.5%
16	2,407	11.9%	0.3%	13.2%
17	2,470	21.7%	0.5%	22.2%
18	2,368	29.6%	1.1%	30.7%
19	2,065	35.1%	1.1%	36.2%
20	1,859	38.1%	1.5%	39.6%
21	1,496	42.2%	2.4%	44.6%
22	1,121	46.0%	2.4%	48.4%
23	839	51.5%	2.9%	54.4%
24	787	55.4%	1.8%	57.2%
25	861	58.8%	2.1%	60.9%

^aAs a percentage of all enrolled women at each age.

is also a steady increase in the proportion of women exclusively receiving follow-up smears for a prior abnormality between age 13 and 23.

The estimated time to a subsequent routine cervical smear, as projected for women with a negative routine cervical smear during the 5-year study window, is reported in Table 4. Because this group excludes women with more frequent follow-up for an abnormal smear at baseline, these results reflect the distribution of screening intervals among those engaged in routine cervical screening. Overall, 36% of routinely screened women were estimated to receive an annual Pap smear, *versus* 22%, 13%, and 9%, with biennial, triennial, and quadrennial screening, respectively. Just over one-fifth of women were estimated to receive a single Pap smear,

Table 4. Estimated frequency of routine cervical screening among women undergoing screening within a 5-year period^a

Age	N	Screening intervals (as a percentage of screened women at each age)					U.S. 5-yr rate of hysterectomy ^b per 100 women
		1 yr	2 yrs	3 yrs	4 yrs	≥5 yrs	
15–19	952	44.5	19.2	11.4	5.0	19.9	0.2
20–24	740	53.1	18.5	7.5	5.8	15.0	0.4
25–29	1,709	52.5	19.0	8.8	8.1	11.7	2.5
30–39	5,432	35.9	22.9	14.7	10.4	16.0	4.2
40–49	7,900	31.0	25.4	15.6	9.1	19.0	5.6
50–59	6,733	35.0	24.3	13.8	7.8	19.2	3.7
60–69	3,382	24.7	21.4	13.2	8.9	31.8	2.0
70–79	1,570	15.3	14.7	9.4	5.0	55.6	1.5
80+	274	9.1	6.1	5.9	4.7	74.2	1.1
Overall ^c		35.7	22.0	13.0	8.5	20.9	3.5

^aResults reflect the estimated time to a subsequent Pap smear among women with negative routine cervical smears and include women undergoing hysterectomy during the follow-up period.

^bEstimates based on data from the National Hospital Discharge Survey.

^cOverall percentages across all ages are age-adjusted to the 1998 U.S. female population.

followed by a period of at least 5 years without a subsequent smear. On the basis of U.S. 5-year hysterectomy rates, only a small proportion of women (3.5%) would be expected to forgo a subsequent cervical smear due to hysterectomy. It was not possible, however, to observe whether a subsequent smear took place beyond 4 years, due to the limited 5-year window of observation.

The youngest age groups featured the most frequent screening intervals, with 53% of routinely screened women ages 20–29 estimated to receive an annual Pap smear. This figure fell to 33% for ages 30–50 and just 9% for women over age 80. The estimated proportion of women with biennial, triennial, and quadrennial screening increased with age from 30% of routinely screened women ages 20–24, to over 45% of those in their 30s and 40s.

The estimated percentage of routinely screened women without a subsequent Pap smear within 5 years ranged from 10% to 20% for ages 15–59, but subsequently increased to nearly 75% of women over age 80. It should be noted that given the continuous enrollment requirements, all women were alive for the 5-year observation period.

Discussion

These are the first age-specific estimates of Pap screening frequency and annual utilization rates in a broad U.S. general healthcare setting, derived from administrative data, rather than self-report.

Overall, one in three female enrollees of any age received a Pap smear in KPNW during 1998. Among adolescents, fewer than 3% initiated screening before age 15. Consistent with evidence from previous studies, screening rates were highest for women ages 25–29 and declined with increasing age (29). On the basis of self-reports from a nationally representative sample of U.S. women in the 1992 National Health Interview Survey (NHIS), the proportion of women reporting a Pap smear during the previous year by age group was 66% (18–29), 50% (30–44), 48% (45–64), and 31% (65+) (7). These figures are all somewhat higher than those found within the same age groups in the 1998 KPNW sample (49%, 48%, 41%, 19%). This was observed in spite of a modest rise in the proportion of U.S. women estimated to receive Pap screening from 1992 to 1998 (6, 30) and the fact that the NHIS sample also includes the uninsured. Thus, all else equal, one would expect the NHIS to yield slightly lower, rather than higher estimates of the proportion screened.

Consistent with previous studies, the most likely explanation for the observed differential is a “telescope” effect in which women report Pap screening more recently than what occurred in practice (9–14). Particularly at younger ages, it is also likely that a proportion of KPNW enrollees elect to receive Pap screening outside their health plan for reasons of confidentiality or convenience. On the basis of data from a national study, however, this proportion appears to be too small to fully account for this differential (31).

Age patterns for vaginal screening in KPNW reflected both an upswing before age 65 due to increasing numbers of women with hysterectomies, and a tendency to forgo Pap screening thereafter in accordance with U.S. Preventive Services Task Force (USPSTF) recommenda-

tions against screening elderly women at low cancer risk with a history of normal smears (18, 25). USPSTF guidelines also recommend against continued screening of women who have undergone cervical hysterectomy for a benign condition (18). Using U.S. hysterectomy rates as a benchmark, approximately one in three women in KPNW with an intact cervix received cervical screening in 1998, compared to an estimated one in seven post-hysterectomy women receiving vaginal screening.

Several studies have attempted to examine the relative benefits of screening at different yearly intervals (32–34). Due to a failure to demonstrate the cost-effectiveness of potentially small risk reductions from more frequent screening intervals (17, 35), the USPSTF has stated that there is no direct evidence that annual screening achieves better outcomes than screening every 3 years (18). Other groups recommend annual screening at younger ages with later reductions in screening frequency at physician's discretion (36). In the KPNW population, annual screening intervals were estimated to be the most prevalent, as exemplified by over one-third of women routinely screened within a 5-year period, and more than half of women ages 20–29. Biennial and triennial intervals were successively less popular. On the basis of these data, the substitution of triennial for annual and biennial screening for most women, consistent with evidence cited by the USPSTF, would reduce the number of women screened each year by approximately 50%. Only 13% of routinely screened women were estimated to use triennial screening in practice.

The estimated proportion of women with sporadic screening intervals longer than every 3 years, and those potentially discontinuing screening, was substantially larger than expected based on prior self-reported estimates of screening coverage (6–8). An estimated 9% of routinely screened women received quadrennial screening, and 20% lacked evidence of a subsequent Pap smear within 5 years. On the basis of U.S. hysterectomy rates, only 3.5% of women would be expected to undergo hysterectomy during this 5-year period. Thus, the vast majority of those without evidence of a subsequent Pap smear within 3 years were likely still at risk for cervical cancer.

On the basis of self-reported data from the NHIS, 97% of women ages 18–29 reporting having ever received a Pap smear indicated that they had been screened within the previous 3 years (7). Within the KPNW sample, however, over 20% of women in this age group were screened less frequently than every 3 years. All else equal, one would expect a higher, rather than lower, proportion of women in the NHIS to be infrequently screened given that this survey samples women without health insurance (30).

Two factors are likely responsible for this discrepancy. First, although it is tempting to interpret having received a Pap smear within the previous 3 years as adequate screening coverage, if a portion of these women is not screened again for several years following the survey, then evidence of a recent smear is likely to mask gaps in care. Second, and of greater concern, is the aforementioned issue of biases in self-reported data that can lead to higher and more recent estimates of Pap utilization than what occurred in practice (10–14). Thus, the present study raises additional concerns that analyses of the

adequacy of Pap screening using nationally self-reported data may fail to capture important gaps in care.

Screening intervals estimated in this paper reflect the utilization patterns of women following a recent cervical smear. Our study design did not allow for evaluation of the proportion of women within each age group who were never screened during the 5-year study window. A previous study in a Minneapolis HMO, demographically similar to the KPNW population, found that only 7–12% of women ages 18–70 with an intact cervix received no Pap smears over a 5-year period, with little variation in these rates across age groups (29). Thus, if one were to include women with an intact cervix without a recent history of cervical screening, the overall proportion of women in KPNW lacking regular cervical screening would likely be slightly higher than the estimates reported here.

Our study has limitations. First, the KPNW population is not representative of all health plans or the U.S. population. In comparing KPNW to other health plans nationally within the HEDIS, the proportion of women with a Pap smear within the previous 3 years in KPNW is slightly above the national average (83% versus 78%) (37). In 1998, 85% of women had health insurance coverage (38). Because most women are insured, in previous studies, the rate of women reporting a recent Pap smear in the general population has been just 2–3% below the rate for the insured population (6, 8). The limitations of self-reported data notwithstanding, based on these estimates, we would expect Pap screening rates within KPNW to be approximately 10% above the U.S. national average. Thus, while not nationally representative, overall estimates from this study are expected to be reasonably comparable to other health plans and the U.S. population as a whole.

Second, to provide an adequate window of observation, analyses of resource utilization and screening intervals were restricted to enrollees with at least 2 and 6 years of continuous health plan enrollment, respectively. Thus, results reflect a continuously insured population. However, in sensitivity analyses, the proportion of women with routine cervical screening in 1998 was found to be similar for the eligible sample including women disenrolling during the follow-up period, and those continuously enrolled from 1997 to 2002 (29% for each group).

In conclusion, although current nationally representative surveys are regarded as adequate for monitoring general trends in Pap utilization for the U.S., concerns over the reliability of self-reported data, and restricted periods of follow-up, limit their usefulness in estimating resource utilization, and preclude analyses of screening frequency (6, 9, 10, 12–14). This paper has examined the utilization and frequency of Pap screening in a U.S. health plan using administrative data. Overall, nearly one in three females within KPNW received a Pap smear in 1998. If extrapolated to the general population (allowing a 10% reduction for the somewhat higher proportion screened within KPNW), this would suggest that an estimated 40 million women received Pap smears in the U.S. in 1998. Despite limited evidence on the benefits of more frequent screening, a substantially higher proportion of women were found to receive annual rather than either biennial or triennial screening. On the other hand, the proportion of

women with sporadic screening was also larger than expected based on prior self-reported data, indicating that further opportunities exist for improving screening adherence, even within traditionally less vulnerable populations (39).

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