Preventive Medicine Reports 9 (2018) 124–130

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Assessment of trends in cervical cancer screening rates using healthcare claims data: United States, 2003–2014

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ARTICLE INFO

Keywords:
Cervical cancer
Claims data
Cervical cancer screening
HPV test

ABSTRACT

Improved understanding of the natural history of cervical cancer has led to changes in screening recommendations, including the addition of the human papillomavirus (HPV) testing as an option in routine screening. Most studies of screening trends have used national self-reported survey data. To better understand recent trends in cervical cancer screening, including cytology (Papanicolaou, or Pap, tests) and human papillomavirus co-tests (HPV + Pap test), we used healthcare claims data to examine screening practices and trends. We analyzed screening among commercially-insured females ages 18–65 during 2005–2014 who were continuously enrolled during three or more contiguous calendar years, to identify those who received cervical cancer screening with a Pap test or co-test. We examined screening prevalence by age group and year. During the latter years of our study period, screening prevalence (regardless of screening method) declined significantly for women in all age groups examined. Despite declines in overall screening, the prevalence of co-testing increased in all age groups except those aged 18–20. In 2014, women aged 30–39 had the highest overall screening uptake (77.5%) and the highest use of co-testing (44.4%); this group also had the lowest overall declines in screening over the time period (−4.5%). These screening measures from healthcare claims were lower than self-reported screening from national surveys of the general population. More research to explore the reasons for these differences is needed to ensure that women are receiving appropriate screening, and to better understand why screening prevalence is declining among this population of commercially insured women.

1. Introduction

Over the past twenty years, the availability of human papillomavirus (HPV) tests and improved understanding of the natural history of cervical cancer has led to changes in screening recommendations. Since 2003, the United States (US) Preventive Services Task Force has recommended cytology (Papanicolaou, or Pap, tests) every three years for most women (U.S. Preventive Services Task Force, 2003). In 2012, all three major organizations that issue cervical screening guidelines adopted consistent recommendations: cytology screening every three years for women aged 21–65, with the option for women aged 30–65 to add the HPV test with the Pap test (co-test) and extend screening intervals to every five years (American College of Obstetricians and Gynecologists Committee on Practice Bulletins–Gynecology, 2016).

In the US, the National Health Interview Survey (NHIS) is used to monitor public health efforts toward achieving national health objectives (Centers for Disease Control and Prevention, 2017; Healthy People 2020, 2016). The NHIS is a population-based sample survey which collects data via in-person interviews. A recent analysis using 2015 NHIS data showed that no group of US women had attained the Healthy People 2020 objective of 93% of eligible women (aged 21–65) receiving cervical cancer screening in accordance with current recommendations (Watson et al., 2017). Screening percentages were particularly low among uninsured women (Watson et al., 2017). Questions about HPV testing were only added to the NHIS beginning in 2015, so the survey cannot yet be used to examine trends in the use of co-tests for recommended screening.

Validation of self-reported cervical cancer screening data has documented frequent overreporting of cervical screening, and women frequently confuse Pap testing with pelvic exams for other reasons (Rauscher et al., 2008). Cervical cancer screening rates have also been examined using data from additional sources such as programs and

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https://doi.org/10.1016/j.pmedr.2018.01.010
Received 11 August 2017; Received in revised form 27 December 2017; Accepted 20 January 2018

healthcare claims (Watson et al., 2015; Tangka et al., 2015; Abdullah et al., 2016). Claims data have been used to assess the impact of screening recommendation updates on mammography rates (Qin et al., 2017), and the potential impact of HPV vaccination on the prevalence of anogenital warts (Flagg et al., 2013; Flagg and Torrone, 2018).

To better understand recent trends in cervical cancer screening (including co-testing) among women with access to private insurance, and to understand how claims data might differ from self-report survey data, we examined cervical cancer screening during 2005–2014 among privately insured women ages 18–65.

2. Methods

2.1. Study cohort

We used data from the *MarketScan® Commercial Claims and Encounters Database*, constructed by Truven Health Analytics (a subsidiary of IBM Watson) (Truven Health Analytics, Ann Arbor MI). Truven collects service-level claims for inpatient and outpatient services from employers and commercially-available private health plans, in exchange for healthcare benchmark reports. The claims and encounters records represent medical experiences of insured employees and their dependents throughout the US. Claims from all primary- and specialty-care providers who submit claims for reimbursement are included. Data are linked at the patient level by a unique encrypted identifier that is consistent across services, health plans, and time; data from individual patients can be linked across multiple years, even if patients change health plans, as long as the employer still reports claims to Truven. All claims have been paid and adjudicated. Healthcare for individuals in the *MarketScan* database is provided by a variety of fee-for-service, fully capitated, and partially capitated health plans, including preferred and exclusive provider organizations (PPOs and EPOs), point of service plans, indemnity plans, health maintenance organizations (HMOs), and consumer-directed health plans.

The number of all *MarketScan* enrollees increased annually from 17.5 million in 2003 to 49.3 million in 2008; the number of enrollees was reasonably stable from 2008 through 2014, ranging from 45.2 to 53.1 million. Approximately 30% of the US populations with employer-provided private health insurance were enrolled in plans contributing data to *MarketScan* as of 2013–2014 (Truven Health Analytics, 2015 and Kaiser Family Foundation, 2017).

We used records for inpatient admissions and outpatient (ambulatory) visits from January 2003 through December 2014 from approximately 150 self-insured employers; these employers participated in 200 national and local health insurance plans and 20 additional regional health insurance plans. We restricted records to those from females aged 16–65 years at the beginning of a calendar year, who were continuously enrolled during three or more contiguous calendar years (e.g., continuously enrolled from January 1, 2005 through December 31, 2007). We aggregated all claims records from providers within each year so that individual females were used as the units of analysis. Each individual could contribute one or more person-years to the analysis, based on having at least three years of continuous enrollment. For example, a woman who was continuously enrolled during 2003–2005 would contribute one person-year of data for 2005 (being considered adequately screened if there were any claims during the three-year window). If this same woman were not enrolled during 2006–2007, and then continuously enrolled again during 2008–2014, she would then contribute six person-years of data: one person-year each for calendar years 2005, and 2010–2014. Results are presented for women aged 18–65 years during 2005–2014.

Females who received cervical cancer screening within a given three year period were identified from claims records within that period containing any one of (a) three *International Classification of Disease, 9th Revision, Clinical Modification* (*ICD-9-CM*) encounter codes or two *Healthcare Financing Association Common Procedural Coding System* (HCPCS) procedure codes indicating a screening Pap test, or (b) 15 *Current Procedural Terminology*, *4th Edition* (CPT-4) or 10 HCPCS codes indicating cervical or vaginal cytopathology, or (c) three CPT-4 codes indicating HPV nucleic acid detection testing (Supplemental Table) (Centers for Medicare and Medicaid Services, n.d.; International Classification of Diseases, 2015; American Medical Association, 2014). Those having records in a given three-year period with none of the above codes, or with only ICD-9-CM codes indicating an encounter for a gynecologic exam without additional evidence of cervical cancer screening, were classified as having no evidence of screening. For women with claims records indicating receipt of an HPV test in January or December of a given year, but with no claims for a Pap test in the same year, we examined records in December of the previous year or January of the following year, respectively, when available (regardless of continuous annual enrollment) to ascertain whether they also received a Pap test within 1–2 months of their HPV test. No information was available on hysterectomy status.

We examined receipt of cervical cancer screening within the past three years using two outcomes of interest:

- Pap test (cytology)
- Co-test (cytology + HPV test; a subset of women having had Pap tests).

A very small percentage of women had records indicating an HPV test without a Pap test (ranging from 0.04% in 2003 to 0.14% in 2014). Because this number was so small, and because we were unable to verify that these women had not had a cytology screening elsewhere, we included these women in the co-test outcome for our analyses. We stratified our analysis by age group (18–20, 21–29, 30–39, 40–49, and 50–65).

2.2. Statistical analysis

We considered the number of females who received cervical cancer screening at least once in a three-year period, with at least two prior years of continuous enrollment, to be adequately screened. We calculated percent prevalence by dividing this number by the total number of screening-eligible females continuously enrolled during the same three-year period. The percentage of women who received a co-test and were screened again in less than five years was estimated using the contiguous four-year period following the year in which co-testing occurred, and was restricted to women who were co-tested in 2003–2010. Confidence intervals (CI) were estimated using log binomial modelling conducted with SAS version 9.3 (SAS Institute, Cary NC). Percent change in prevalence over the entire time period was calculated as the difference between the average rate of the first 2 years and the average rate of the last 2 years, divided by the average rate of the first 2 years (National Cancer Institute, n.d.). Annual percent change (APC) in prevalence was estimated using Joinpoint software version 4.2.0 (National Cancer Institute, Bethesda MD), which fits trend data to identify the log-linear model with the fewest number of inflection points (joinpoints); APC was based on the log-linear slope of the trend segment between joinpoints (Kim et al., 2000).

3. Results

The *MarketScan* 2003–2014 data contained 213 million person-years of data from 76 million individual females. Sixty million (79%) of these individuals were aged 16–65 during this time period, and of these, 42 million (70%) were continuously enrolled during three or more contiguous calendar years, contributing almost 89 million person-years of data to the analysis (Table 1). Overall, 5% of person-years were contributed by women aged 18–20 years, while 11%, 20%, 26%, and 38% of person-years were contributed by women aged 21–29, 30–39, 40–49, and 50–65, respectively. Most observations were from enrollees