Use of claims data to estimate annual cervical cancer screening percentages in Portland metropolitan area, Oregon

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A B S T R A C T

Background: Human papillomavirus (HPV) vaccine should reduce cervical dysplasia before cervical cancer. However, dysplasia diagnosis is screening-dependent. Accurate screening estimates are needed.
Purpose: To estimate the percentage of women in a geographic population that has had cervical cancer screening.
Methods: We analyzed claims data for (Papanicolau) Pap tests from 2008–2012 to estimate the percentage of *insured* women aged 18–39 years screened. We estimated screening in *uninsured* women by dividing the percentage of insured Behavioral Risk Factor Surveillance Survey respondents reporting previous-year testing by the percentage of uninsured respondents reporting previous-year testing, and multiplying this ratio by claims-based estimates of insured women with previous-year screening. We calculated a simple weighted average of the two estimates to estimate overall screening percentage. We estimated credible intervals using Monte-Carlo simulations.
Results: During 2008–2012, an annual average of 29.6% of women aged 18–39 years were screened. Screening increased from 2008 to 2009 in all age groups. During 2009–2012, the screening percentages decreased for all groups, but declined most in women aged 18–20 years, from 21.5% to 5.4%. Within age groups, compared to 2009, credible intervals did not overlap during 2011 (except age group 21–29 years) and 2012, and credible intervals in the 18–20 year group did not overlap with older groups in any year.
Conclusions: This introduces a novel method to estimate population-level cervical cancer screening. Overall, percentage of women screened in Portland, Oregon fell following changes in screening recommendations released in 2009 and later modified in 2012.

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1. Introduction

Cervical intraepithelial neoplasia and adenocarcinoma in situ (CIN2+) are high grade cervical lesions caused by persistent infection with human papillomavirus (HPV) [1]. Although asymptomatic, these lesions can progress to invasive cervical cancer. CIN2 + can be detected and treated through routine cervical cancer screening with the Papanicolau (Pap) test which has been the basis of cervical cancer prevention since the 1950s [2]. During 2008, in collaboration with the Centers for Disease Control and Prevention (CDC), five states including California, Connecticut, New York, Tennessee, and Oregon established population-based surveillance of CIN2+ in order to monitor the impact of HPV vaccines that target the HPV types that cause the majority of CIN2+ and cervical cancers

[3]. However, diagnosis of CIN2+ is screening-dependent, and directly impacted by recent changes in recommendations for older age at first screening and longer screening intervals for all ages [4]. Therefore, accurate estimates of the percentage of women screened are needed to determine the independent impact of HPV vaccination on reducing the burden of CIN2+.

Determining the actual number of women screened in the United States is challenging. New Mexico has the only existing state-level cervical cancer screening registry, established in 2006 [4]. Collecting cervical cancer screening information from labs would be resource intensive and add substantial reporting burden for laboratories. Women may have multiple Pap tests in one year from the same or different providers leading to overestimation of cervical cancer screening percentages, if data are not de-duplicated.

Historically, estimates of cervical cancer screening percentages in the U.S. have been obtained from national surveys such as the National Health Interview Survey (NHIS) and the Behavioral Risk Factor Surveillance System (BRFSS) survey [5,6]. These data are

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self-reported and are subject to reporting bias, leading to overestimation of cervical cancer screening percentages [7]. In addition, surveys produce national and state-level estimates, but lack granularity to produce precise estimates for smaller areas. Non-telephone-equipped households, cell phone-only households, and increased non-response percentages have also become a growing challenge for telephone surveys [8].

Administrative health care claims data represent an alternative data source for estimating the percentage of insured women that receive a Pap smear. Claims data have been used within health plans to measure the percentage of women with recent Pap tests in closed populations [9]. In a study published in 2004, Insinga et al. used claims data for enrollees ≥10 years old insured by the Kaiser Permanente Northwest (KPNW) health plan and estimated an annual Pap smear percentage of 31.2 per 100 women enrolled [10]. However, claims data provide no estimates of Pap smears among uninsured women. In the current study, we aimed to estimate cervical screening percentages among women residing in the Portland, Oregon metropolitan area, one of the 5 defined geographic areas established to monitor HPV vaccine impact on CIN2+. Specifically, we used claims data to directly estimate the percentage of insured women living within the catchment area and enrolled in a variety of health plans that received at least one Pap test during a calendar year, and adjusted these estimates by the relative frequency of Pap tests among uninsured women to derive an indirect estimate of screening in uninsured women. Finally, we combined these two estimates to arrive at an estimate of the percentage of the entire population screened.

2. Methods

2.1. Study population

The Oregon Health Authority (OHA), Public Health Division, conducts CIN2+ surveillance among women who reside in a contiguous 28-zip-code area of the Portland metropolitan area. Women were included in the study if they were aged 18–39 years, resided in the catchment area, and had at least one Pap smear in a calendar year. We categorized women into three age groups: 18–20, 21–29, and 30–39 years. We chose these age groupings because they coincide with the ages for which screening recommendations vary. We cut the upper age group off at 39 years because this is the upper age limit for inclusion in the CIN2+ surveillance project. In 2010, 119,558 women aged 18–39 years lived in the surveillance area [11]. An estimated 79.3% of this population had health insurance coverage, defined as individual, group, Medicare, Medicaid, or a combination of these [12].

2.2. Data sources

We acquired county-level population data by age in 1-year intervals from the U.S. census [11]. We used estimates of percentages of insured and uninsured women in the catchment area from the American Community Survey (ACS) (Table 1).

Administrative claims data for health plan enrollees were obtained from Quality Corporation (QCorp). QCorp is a non-profit organization that collaborates with health insurance companies, Medicaid, and Medicare in Oregon to collect and compile healthcare-related administrative claims data [13]. Both private and public health care insurers use these data to track and report on performance measures. QCorp reports that claims data are available for approximately 85% of the insured population in the catchment area. We used QCorp-supplied claims data for services provided during 2008–2012 to determine whether a claim for a Pap test had been submitted on behalf of a woman enrolled by any of the collaborating insurers. QCorp mostly used Current Procedure Terminology (CPT), and Health Care Procedure Coding System (HCPCS), and on rare occasions, Hospital Revenue Code sets, and International Classification of Diseases (ICD) codes to identify Pap claims (see Appendix A for a list of codes). These codes are included in the specifications for the National Committee for Quality Assurance (NCQA) Healthcare Effectiveness Data and Information Set (HEDIS) cervical cancer screening measure. QCorp also provided a count of insured women by age and county of residence whose claims would have been eligible to be captured, i.e., "number enrolled."

We used survey responses to the Oregon Behavioral Risk Factor Surveillance System (BRFSS) to determine *relative frequency of cervical screening* among uninsured and insured women, but not to directly estimate the percentage of insured or uninsured women that had a Pap test [14]. BRFSS surveyors asked respondents if they ever had a Pap test, and how long it had been since they had their last Pap test. In addition, the survey included a question about whether or not a respondent had health insurance, and asked respondents if they had any kind of health care coverage, including individual or group health insurance, prepaid plans such as HMOs, or government plans such as Medicare. The BRFSS survey is conducted by telephone and is designed to produce state-level estimates [15].

2.3. Analysis

We estimated the percentage of women living in the catchment area with at least one Pap test during a calendar year differently for insured and uninsured women as outlined below and in Fig. 1.

(A) Screening percentage estimation among *insured* women with ≥1 Pap smear during a calendar year:

First we estimated the number of insured women living in the catchment area by age group by multiplying US Census population estimates by estimates of the percentage of the population insured from the American Community Survey (ACS). ACS data offered only one overall estimate of the percentage insured by year for so we used that same estimate for all age groups. Then, we estimated the percentage of all insured women whose claims were captured by QCorp by dividing the number of enrollees reported by QCorp for calendar year by our census- and

Table 1
Data sources used to estimate cervical cancer screening percentages.

Data source	Data obtained
Census data	Population counts
American Community Survey	Estimates of percentage of insured and uninsured women
Claims administrative data	De-duplicated counts of women enrolled in a health plan
	De-duplicated counts of insured women who had a Pap
Oregon's behavioral risk factor	Pap percentage in insured and uninsured women
Surveillance system (BRFSS)	Relative frequency of Pap smear among uninsured and insured women