Monitoring the Impact of Human Papillomavirus Vaccines on Precancerous Cervical Lesions: Designing a Framework of Linked Immunization Information System and Cancer Registry Data in Michigan

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Background

The impact of HPV vaccine on cervical cancer may be monitored by linking immunization and cancer registry data. Michigan is uniquely positioned to examine the most important cancer precursor, cervical intraepithelial neoplasia grade 3 (CIN3), by vaccination status, using two population-based resources.

Objective

Assess the feasibility of identifying a cohort of women from the MCIR who had continuously resided in Michigan and linking their MCIR and MCSP records.

Methods

Data Sources

Michigan Cancer Surveillance Program (MCSP)
- Statewide population-based cancer surveillance system that began in 1985
- Passive registry that collects a North American Association of Central Cancer Registries standard data set from reporting hospitals and laboratories.
  - Supplemented with information from physicians, clinics, and inter-registry resident case exchange with 18 other statewide registries.
- All in situ and invasive cancers are reportable to the registry, excluding only basal or squamous cell carcinomas in non-genital skin.

Michigan Care Improvement Registry (MCIR)
- Statewide immunization information system (IIS) created in 1998
- Providers required to report school-exclusionary vaccinations administered to persons age less than 20 years and may electively report others.
- Linkage with Vital Records data continually "seeds" live-birth data for all Michigan births after 1994.

Michigan Live Birth File (LBF)
- Comprised of data reported to the Michigan Department of Community Health Division for Vital Records and Health Statistics on every infant born in Michigan.
- Includes a birth identifier number for the child
- Provides additional information on both the child and its parents, including first name, last name, birth date, and address.

Lexis-Nexis® Accurint®
- An online record locator service that provides an extensive address history on specific individuals through a Web-based interface and through an online batch upload process.
- Accurint® derives its databases from legal and financial transactions
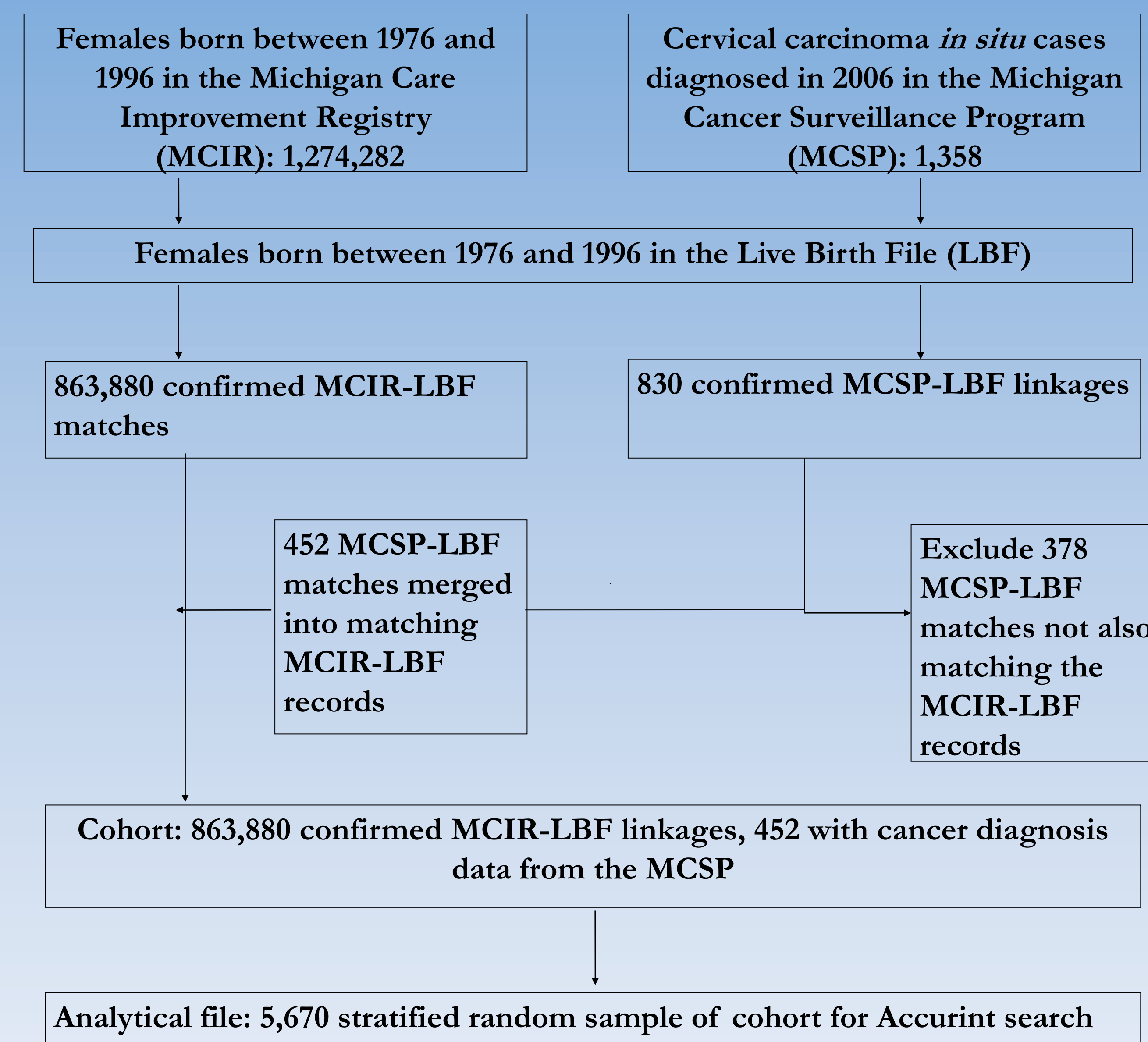- Federally regulated access

Steps (Figure 1)
1. Identify all females born between 1976 and 1996 in MCIR.

2. Identify all cervical carcinoma in situ cases diagnosed in 2006 among women 30 years of age or younger in the MCSP.

3. Establish Michigan birth. We used Registry Plus™ Link Plus version 2.0, a probabilistic matching software package, to match the women from MCIR (step 1) and the MCSP (step 2) with females born between 1976 and 1996 in the LBF.

Methods

4. Merge data from records for Michigan-born age- and diagnosis-eligible women in the MCSP (MCSP-LBF records) to those in the MCIR-LBF cohort using the LBF birth identifier number. Women who were in the MCSP and LBF, but not in MCIR, were excluded from the study.

Figure 1 . Creation of the analytical file

5. Establish continuous Michigan residence. Due to resource constraints, we submitted an age-stratified random sample of 5,670 of the conclusively-linked women from the cohort to Accurint®. For each woman, we created up to four records using information drawn from the LBF for the woman, her mother (using both current and maiden name), and her father. Each record included first, middle, and last name, date of birth, social security number (for the records of the mother and, if available, the father), and the mother's address at the time of delivery.

Results

Linkage between MCSP and LBF
- 1,358 age-eligible pre-invasive cervical cancer cases in the MCSP
  - 830 links (61.1%) to the LBF

Linkage between MCIR and LBF
- 1,274,282 MCIR records
  - 863,880 (67.8%) conclusive links to the LBF

Results

Table 1. Conclusive Linkages between MCSP and MCIR with LBF by year.

Birth Year / Years of Age	Women in MCIR	Women in MCIR Linked to LBF		Pre-Invasive Cervical Cancer Cases	Cases Linked to LBF		LBF-Linked cases in LBF-MCIR file	
		N	(%)		N	(%)	N	(%)
1976 / 30	9,982	2,412	(24.2)	44	15	(34.1)	3	(20.0)
1977 / 29	11,031	3,001	(27.2)	93	42	(45.2)	7	(16.7)
1978 / 28	12,769	4,684	(36.7)	115	51	(44.3)	9	(17.6)
1979 / 27	19,703	10,023	(50.9)	115	64	(55.7)	12	(18.8)
1980 / 26	28,081	16,390	(58.4)	141	70	(49.6)	25	(35.7)
1981 / 25	34,616	21,520	(62.2)	141	81	(57.4)	30	(37.0)
1982 / 24	43,235	27,452	(63.5)	120	77	(64.2)	49	(63.6)
1983 / 23	47,465	30,858	(65.0)	134	93	(69.4)	51	(54.8)
1984 / 22	53,120	35,339	(66.5)	99	70	(70.7)	47	(67.1)
1985 / 21	58,832	39,440	(67.0)	105	76	(72.4)	53	(69.7)
1986 / 20	65,844	45,225	(68.7)	81	62	(76.5)	44	(71.0)
1987 / 19	80,851	56,674	(70.1)	79	61	(77.2)	60	(98.4)
1988 / 18	84,687	58,371	(68.9)	49	36	(73.5)	35	(97.2)
1989 / 17	90,092	62,111	(68.9)	28	22	(78.6)	22	(100)
1990 / 16	94,330	65,300	(69.2)	11	8	(72.7)	8	(100)
1991 / 15	93,400	64,701	(69.3)	3	2	(66.7)	2	(100)
1992 / 14	90,071	62,466	(69.4)	0	0	***	0	***
1993 / 13	87,796	61,719	(70.3)	0	0	***	0	***
1994 / 12	91,232	66,524	(72.9)	0	0	***	0	***
1995 / 11	89,004	64,984	(73.0)	0	0	***	0	***
1996 / 10	88,141	64,686	(73.4)	0	0	***	0	***
All Years	1,274,282	863,880	(67.8)	1358	830	(61.1)	457	(54.5)

Continuous Residence
- 21,542 records were prepared and submitted to Accurint®.
  - Linkage rate using the case's name was poor (14.1%).
  - Using mother's current name, linkage rates increased from 89.2% in the 1976 – 1978 birth year cohort to 99.1% in the 1994 – 1996 cohort.
  - Comparable linkage rates were found with father's name (range: 89.6% – 98.2%) and mother's maiden name (range: 81.9% - 98.1%).
  - All parental linkage rates increased with birth year cohort.
- We identified 4,870 females (85.9%) of Michigan-born women whose address history indicated that neither they, nor their mother or father, had ever resided outside of Michigan from birth to 2006.

Conclusions

The study methodology was feasible and used existing data sources. Its strengths are the high proportion of linkages and population-based data. Future steps include a study using MCIR-birth linked records for HPV vaccination-eligible women.