A Systematic Evaluation of Different Methods of Calculating Adolescent Vaccination Levels Using Immunization Registry Data

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Background

- Immunization information systems (IISs) are valuable population-based surveillance tools.
- Defining the population eligible to receive vaccines is a key consideration when using an IIS to determine vaccination levels.
- Incomplete data due to in- and out-migration may affect the accuracy of the eligible population and introduce bias into the determination of immunization levels.

Objective

To systematically evaluate the degree to which different methods of determining the vaccine-eligible population in an IIS may result in variation in calculated adolescent immunization coverage levels.

Methods

Study Population

The Michigan Care Improvement Registry (MCIR) was used to: 1) determine county of residence and Moved or Gone Elsewhere (MOGE) status; and 2) assess coverage levels (using the ACIP vaccine schedule) for the following adolescent vaccines among children 11-18 years: Tdap (tetanus-diphtheria-acellular pertussis); MCV4 (meningococcal conjugate); Flu (seasonal influenza); and HPV (human papillomavirus) vaccine (among females only).

Alternative Denominator Definitions

Four different vaccine-eligible populations were defined:

- **MCIR Inclusive** contained all adolescents with MCIR records (reference group);
- **Exclude MOGE** excluded adolescents identified as having moved out of state;
- **Exclude MOGE and Inactive** further excluded those with no activity on their MCIR records for ≥10 years;
- **Census** used U.S. census data from 2007 to extrapolate the adolescent population in 2010.

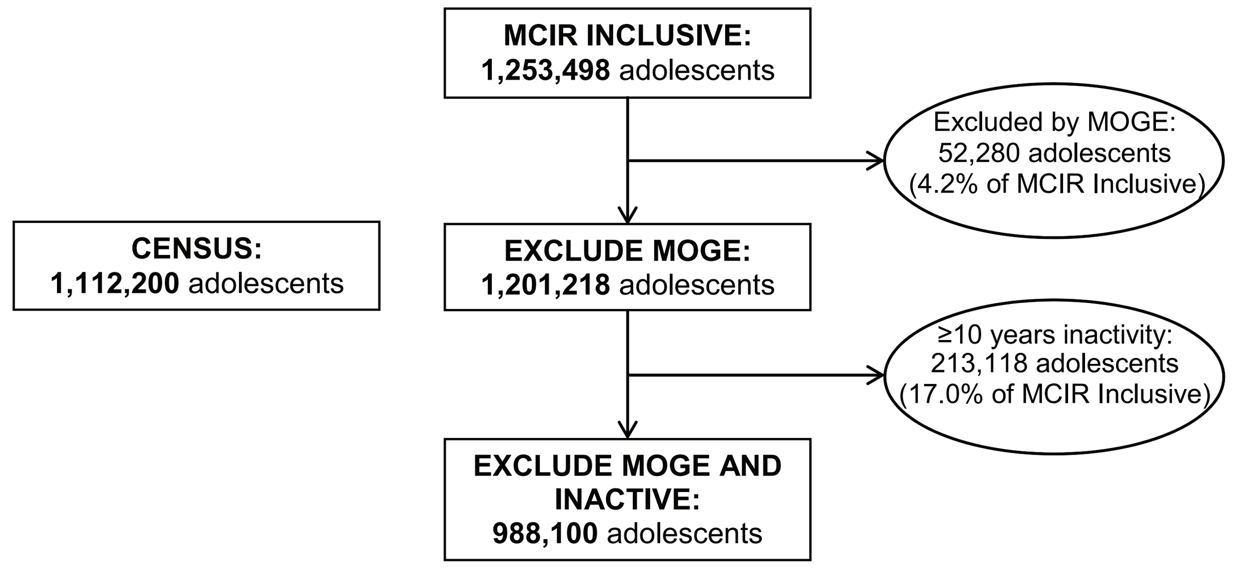
Analyses

- County-specific coverage levels for each of the four vaccines were calculated using the four different vaccine-eligible populations.
- Maximal difference in coverage levels was defined for each county and vaccine as the difference between highest and lowest calculated levels.
- Quartile categories of county vaccination levels across methods were identified. The number of counties that migrated across quartiles when comparing calculation methods was assessed.

Results

Study Population

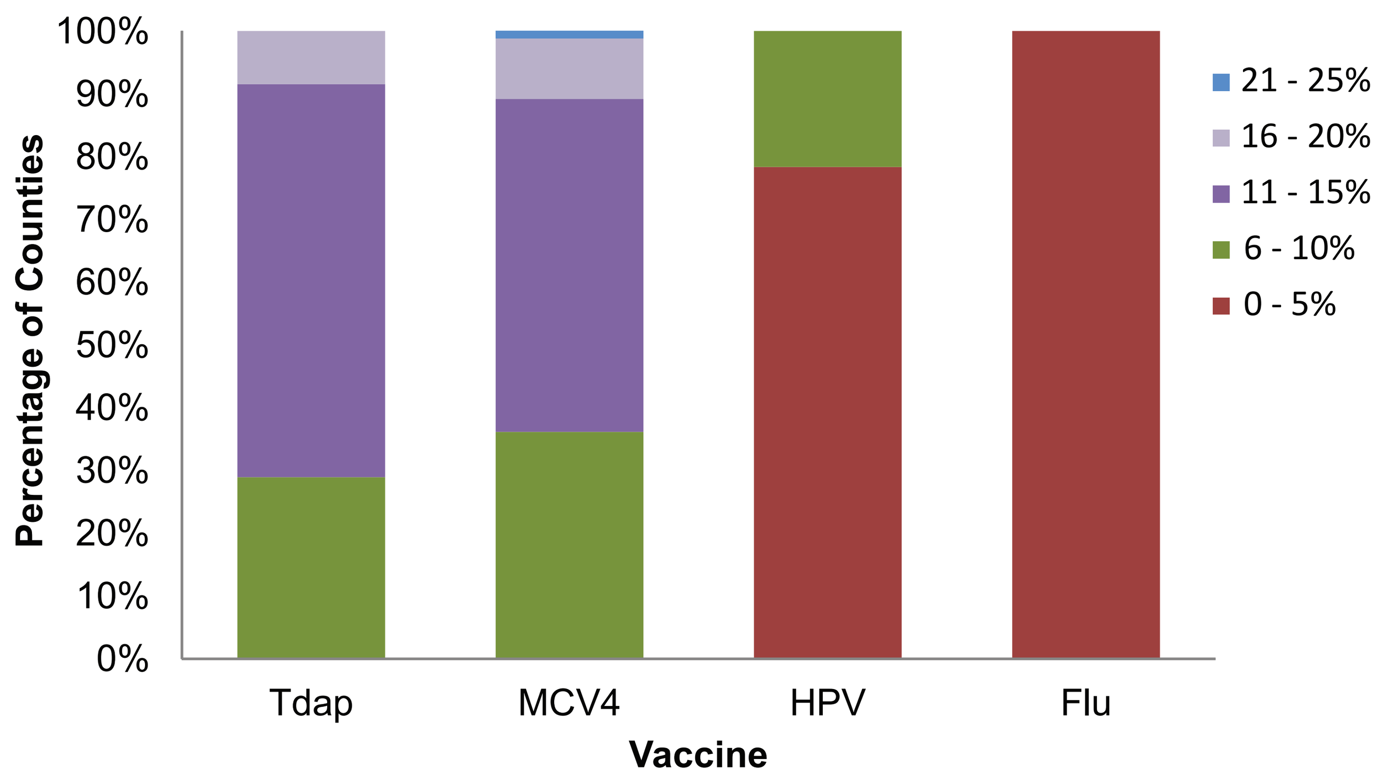
- A total of 1,253,498 adolescents were identified after excluding: those without valid county of residence (n=121,562); duplicate records (6,679); and deceased adolescents (n=4,264).
- The populations of vaccine-eligible adolescents determined using the different methods varied substantially in size, as shown below.



Variation in Vaccination Levels Across Methods

- Though there was some variability in vaccination levels (2 to 11 percentage-points, depending on vaccine) at the state level, there was greater variation in county-specific levels (up to 21 percentage-points depending on county and vaccine).
- The majority of counties had maximal differences in vaccine coverage levels of ≥11 percentage-points for Tdap and MCV4, whereas no counties had maximal differences of >10 percentage-points for HPV and Flu.

Figure. Maximal Variation in Adolescent Vaccine Coverage Levels.



Results (cont.)

Movement in County Quartile Rankings

- County quartile rankings varied based on the method used to calculate vaccine coverage levels. Most movement occurred when comparing levels calculated using MCIR Inclusive vs. Census denominators.
- Vaccines with the greatest variation in calculated coverage levels (Tdap and MCV4) had the highest number of counties (11 – 39) that migrated between quartiles when comparing different methods.
- Approximately 15 to 51% of MI adolescents resided in the counties that migrated between quartiles.

Table. Migration in Percentile Categories by Different Calculation Methods[a]

	Comparison between **MCIR Inclusive** versus					
	Exclude MOGE		**Exclude MOGE and Inactive**		**Census**	
	# of counties (% of adolescents) that move		# of counties (% of adolescents) that move		# of counties (% of adolescents) that move	
	≥1 quartile	≥2 quartiles	≥1 quartile	≥2 quartiles	≥1 quartile	≥2 quartiles
Tdap[b]	11 (51%)	1 (0.1%)	18 (50%)	1 (0.1%)	37 (30%)	6 (4%)
MCV4[b]	17 (15%)	1 (0.1%)	22 (24%)	0 (0%)	39 (47%)	5 (4%)
≥3 HPV doses[c]	6 (6%)	0 (0%)	20 (9%)	0 (0%)	29 (11%)	0 (0%)
Flu[b]	9 (4%)	0 (0%)	15 (8%)	0 (0%)	27 (15%)	0 (0%)

[a] The number of counties (out of 83 total) that move quartiles depending on the vaccine-eligible population used to calculate adolescent vaccination levels. Quartiles are defined as <25th, 25th to <50th, 50th to <75th, ≥75th percentile.

[b] For these vaccines, the percentages are provided of the total MI adolescent population (n=1,112,200 using U.S. census estimates) residing in the counties that migrate quartiles.

[c] For HPV, the percentages are provided of the total MI adolescent female population (n=565,754 using U.S. census estimates) residing in the counties that migrate quartiles.

Conclusions

- Substantial differences in calculated vaccine coverage levels were found based on whether the state IIS or U.S. census data was used.
- We found that the calculation method led to notable differences in how counties might rank among each other.
- This potential for disparity in calculations should be considered when evaluating immunization programs and policies or determining appropriate resource allocation within a state.

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