



Advancing Public Health Outcomes Through Information Technology

“Uptake of Meningococcal Vaccine in Arizona School Children after Implementation of Immunization Requirements at School Entry”

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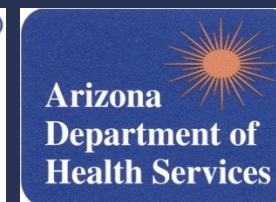
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Overview



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- Background and history
- Purpose and scope
- Methods
- Results
- Discussion
- Further directions



Background and history



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➤ Infectious agent:

➤ *Neisseria meningitidis*

- A bacterium causing meningitis and bacteremia
- Can result in brain damage, amputations, death (mortality is 10-14%)
- Transmitted via droplet respiratory secretions of infected patients or asymptomatic carriers.
- 3 vaccines are currently licensed in U.S.

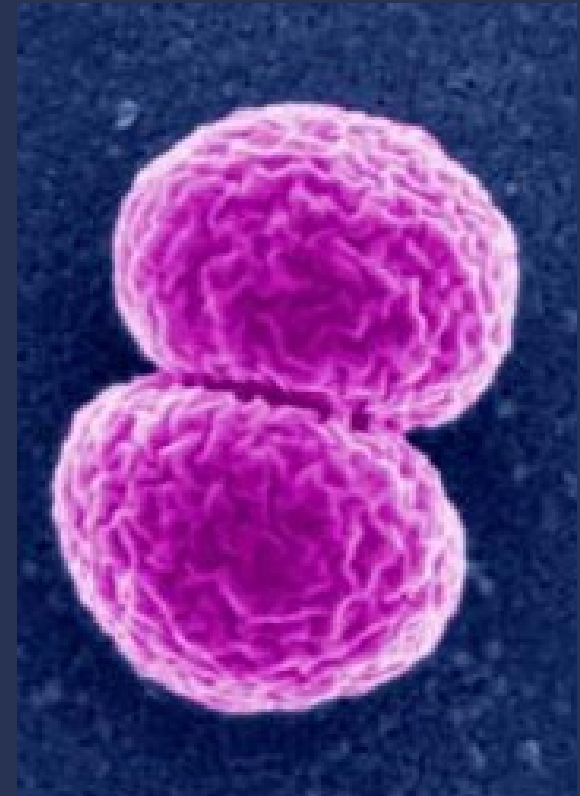


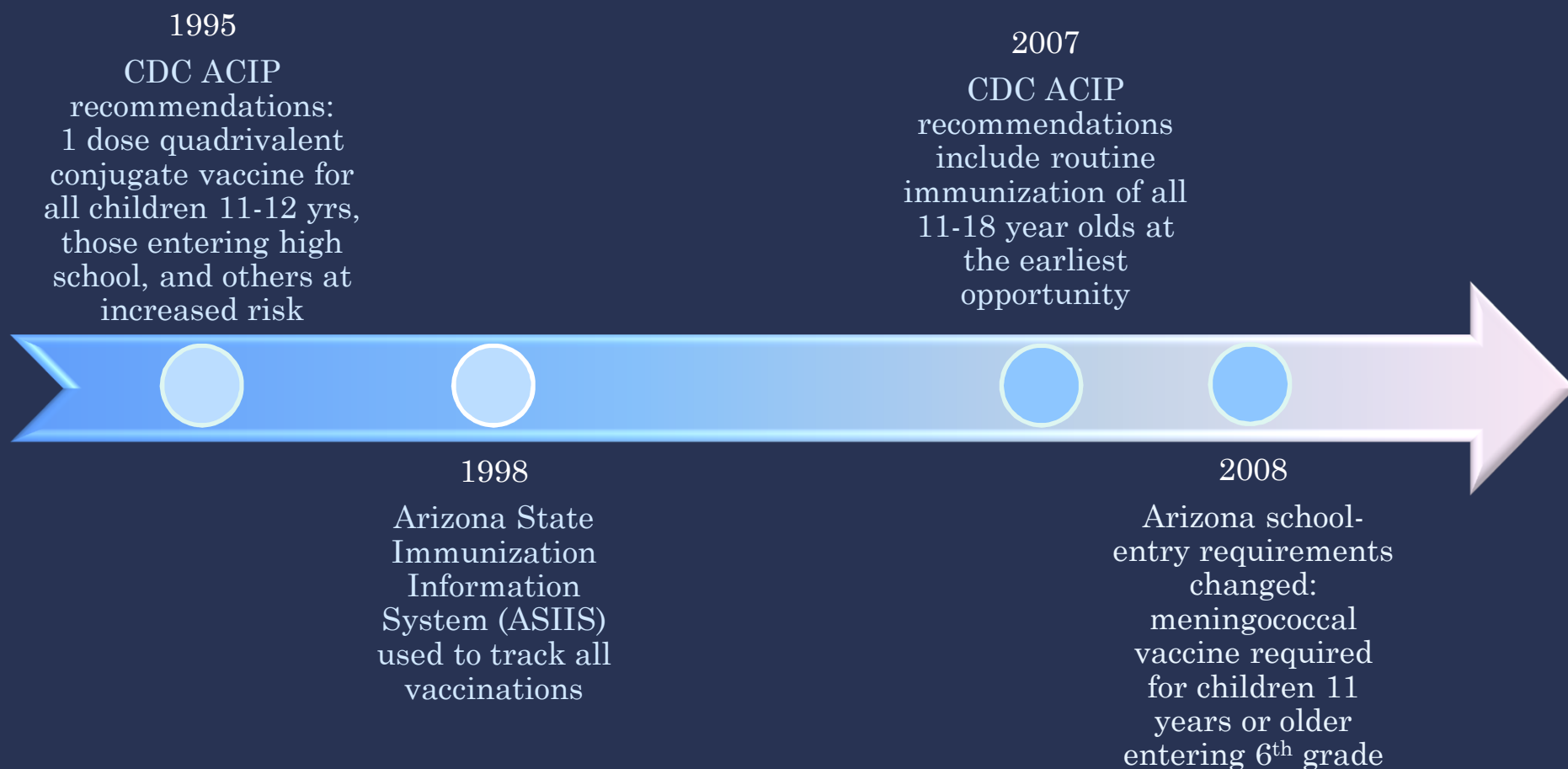
Photo taken from:
<http://www.austince.edu/microbio/2993q/nm.htm>

Background and history



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➤ Vaccination recommendations and requirements timeline



Research questions



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➤ Although vaccination rates do appear to be increasing in Arizona, and nationally, questions remain regarding...

1. How does policy (i.e. school-entry requirement) change affect overall vaccine uptake?

and

2. What are differences among sub-populations in terms of vaccine uptake as a response to policy?



Purpose and scope of this study



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- This study describes patterns in meningococcal vaccine uptake in 11 and 12 year old children in Arizona.
- We determine the odds of on-schedule vaccination after school requirements changed to include meningococcal vaccination, as opposed to before the state statute change.
- We compare odds of on-schedule vaccination between several key demographic populations in Arizona.

Methods - overview



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1. Immunization Information System (ASIIS) records from 2006-2010 were used to compare on-schedule meningococcal vaccine coverage in 11 and 12 year olds.
2. Logistic regression modeling to determine odds of on-schedule vaccination following Arizona requirements change (post 2008).
3. Principle Component Analysis and hierarchical Cluster Analysis were used to identify and analyze 8 key demographic groups in AZ
in terms of their response to requirements change.

Methods – on-schedule vaccination coverage



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- We calculated on-schedule coverage as
 - proportion of children vaccinated at 11 and 12 years of age for each school year (SY) from 2006 through 2010.
 - Children receiving the meningococcal vaccination during their 11th or 12th years were considered on-schedule.
 - Vaccine coverage for children ages 11 and 12 years was calculated both prior to, and after, implementation of the school requirement
- Coverage =
$$\frac{\text{\# children age 11 or 12 and vaccinated}}{\text{Total \# children in ASIIS 11 or 12 years old}}$$

Methods – Odds Ratios



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➤ Odds Ratio (OR)

- measure of the size of an effect
- In statistics, the *odds* of an event occurring is the probability of the event, divided by the probability of an event *not* occurring (this is different than the colloquial “odds”)
- a descriptive statistic that plays an important role in logistic regression.
- can be estimated when using non-random samples.
- Ranges between 0 to ∞ .

“For most clinicians, odds ratios will remain . . . well, odd.”

-- Grimes & Schulz, 2008

Methods – PCA and Cluster Analysis



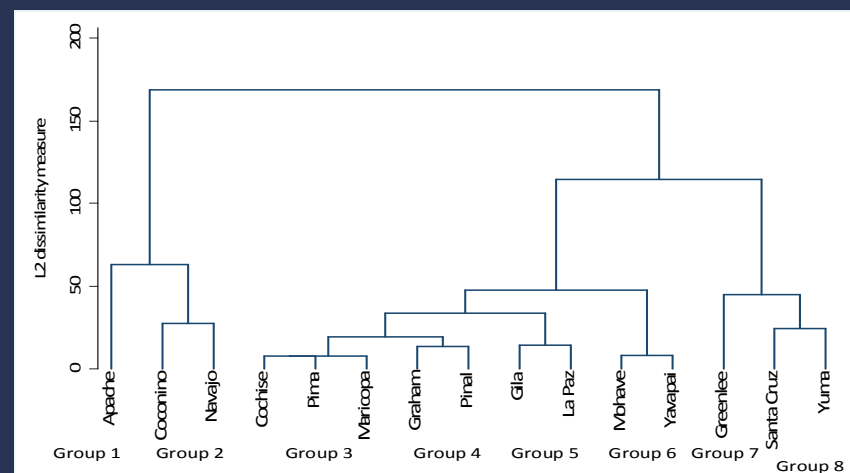
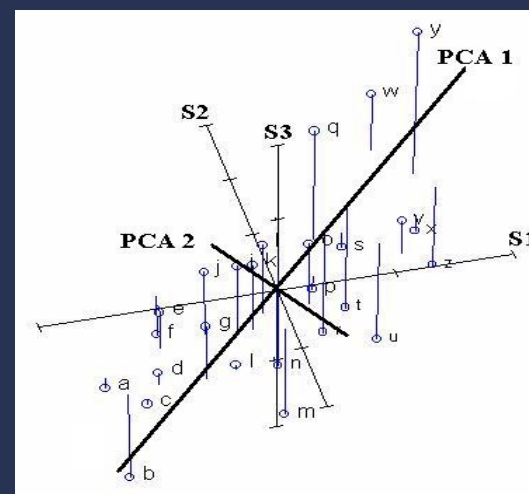
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➤ PCA –

➤ Rotates your multi-dimensional data points to identify most important gradients

➤ Cluster Analysis –

➤ groups geographic areas according to similarities in variables with most important gradients (from the PCA)



Results – Coverage, on-schedule vaccinations



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Characteristic	School Year				2010 Census ^c
	2006–2007 ^b	2007–2008 ^b	2008–2009 ^b	2009–	
Age: 11 years					
Total Pop. Sept.1	133,306	135,107	138,634	139,747	89,797
Vacc. by Sept. 1	26,852 (20.1%)	65,075 (48.2%)	67,019 (48.3%)	68,167 (48.8%)	67,230 (74.9%) ^d
Vacc. b/w Sept. 1 and recent birthday (19.9%)	26,509	62,669 (46.4%)	62,833 (45.3%)	64,190 (45.9%)	
Age: 12 years					
Total Pop. Sept.1	142,097	133,306	135,107	138,634	89,061
Vacc. by Sept. 1	29,882 (21.0%)	53,725 (40.3%)	75,015 (55.5%)	75,962 (54.8%)	76,425 (85.8%) ^e
Vacc. b/w Sept. 1 and recent birthday (16.9%)	24,053	26,873 (20.2%)	9,940 (7.4%)	8,943 (6.5%)	

^b According to records in the ASIIS; ^c The U.S. Census Bureau measures decennial census data, thereby limiting U.S. Census-derived immunization rate comparison with 2010; ^d Vaccinated by 11 years of age;

^e Vaccinated by 12 years of age.

*Increase in coverage from 2007 to 2008 ($p < 0.0001$ @ $\alpha=0.95$)

Results – demographic groups



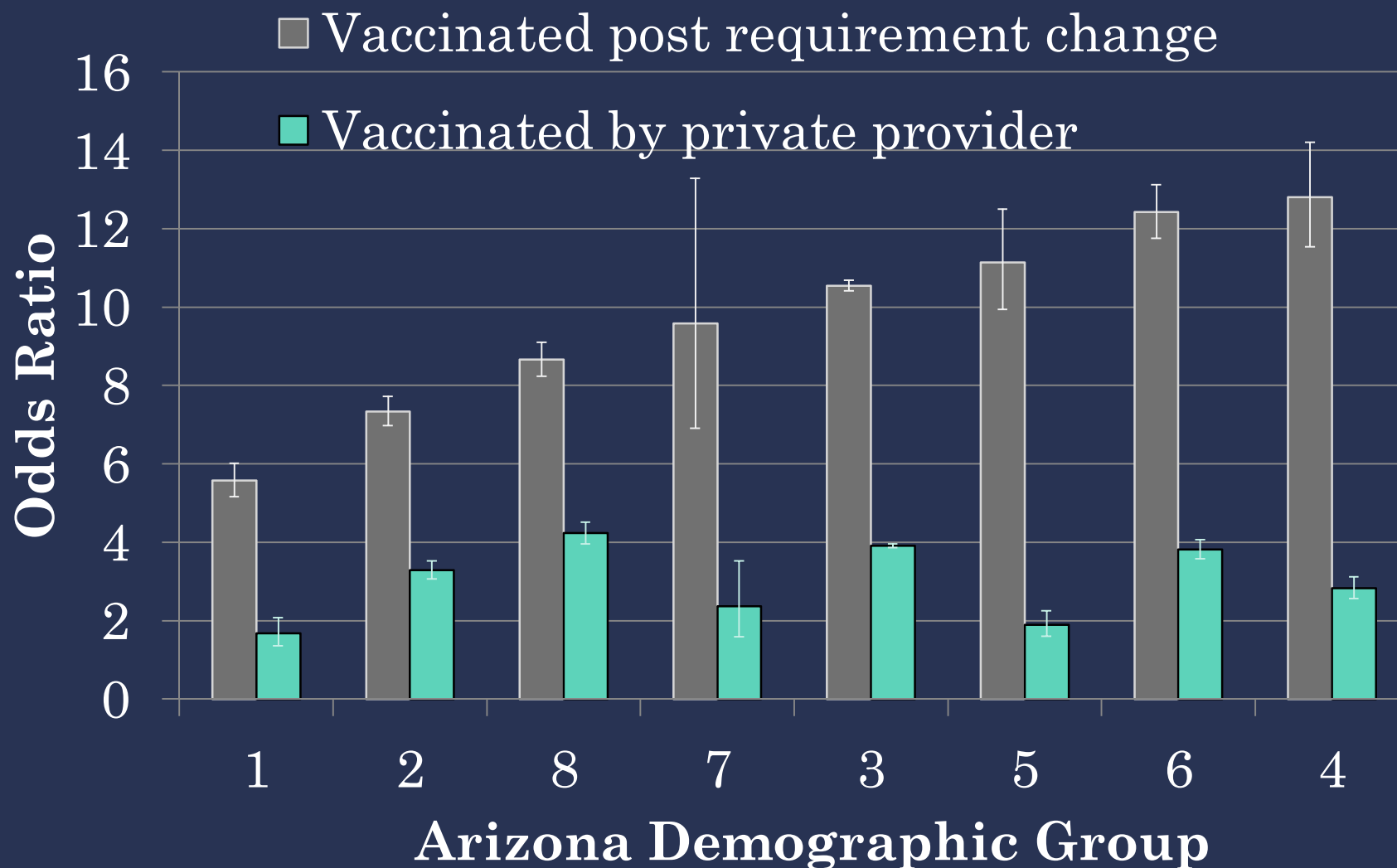
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	<u>ODDS</u>	<u>Children</u>	<u>Education</u>	<u>Income</u>			<u>Race</u>					
	Post rule odds vacc'd by 12 yrs	Pers per house >2.76	Under 18 yrs >25.5%	High school grads <83.9%	College grads < 25.7%	Pov- erty >16.5 %	Own home <68.3 %	Median house- hold income < 40K	Nat. Amer. >4.6%	Hisp. >29.6 %	white >73%	Demo- graphic Profile
Group 1	5.57	Y	Y	Y	Y	Y		Y	Y			More children, less education, more poverty, more native American, less white
Group 2	7.34	Y	Y	Y	Y	Y	Y		Y			
Group 8	8.66	Y	Y	Y	Y	Y		Y		Y		
Group 4	12.81		Y	Y	Y	Y			Y			Somewhat more children, more HS education, more poverty, racially diverse
Group 5	11.14			Y	Y	Y		Y	Y		Y	
Group 7	9.58		Y		Y		Y			Y	Y	
Group 3	10.55					Y				Y	Y	Less children, more educ., less poverty, more white
Group 6	12.42										Y	

Results – OR on-schedule vaccination coverage



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Results – demographic groups



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- All demographic groups had higher odds of an on-schedule vaccination after the school entry requirement change than prior to rule.
 - ORs range = 5.57 to 12.81 ($p < 0.0001$)
- Counties' demographic factors associated with lower odds of on-schedule vaccination included:
 1. higher poverty rates
 2. more children <18 (more children per household)
 3. fewer high-school graduates
 4. higher proportion of Native American population

Discussion



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- Our analysis suggests that implementation of school immunization requirements resulted in increased meningococcal vaccination rates in Arizona.
- One challenge is to identify appropriate methods that control for over-estimates of total population in IIS data.
 - Census is not necessarily the answer.



Discussion



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- Our study represents an investment in data and analytics by AZ.
 - Using data they already have to explore the influence of immunization policies on vaccine up-take.
 - An applied use of IIS data sets.
- Lower magnitude of response to rule change does not equate to lower overall immunization rates
 - Outreach and education programs may influence rates prior to a policy or rule change.
 - We are evaluating the magnitude of a response.

A screenshot of the 'STC MyWeb' interface. It displays a table with multiple columns, including 'Category', 'Value', 'Unit', 'Description', and 'Status'. The table contains data for various categories like 'Immunization', 'Vaccine', and 'Policy'. The interface also includes a sidebar with navigation links and a header with the STC logo and user information.

Category	Value	Unit	Description	Status
Immunization	100	%	Immunization Rate	Good
Vaccine	100	%	Vaccine Uptake	Good
Policy	100	%	Policy Compliance	Good



Discussion – demographic groups

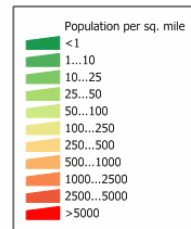


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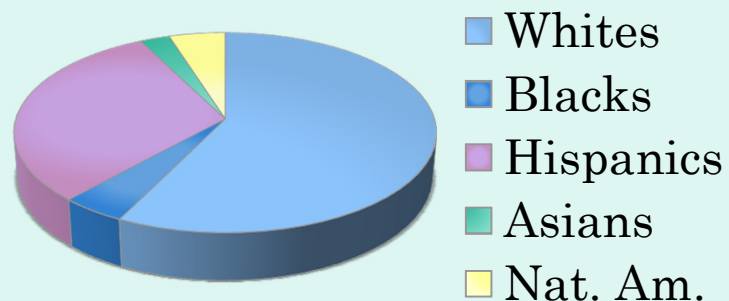
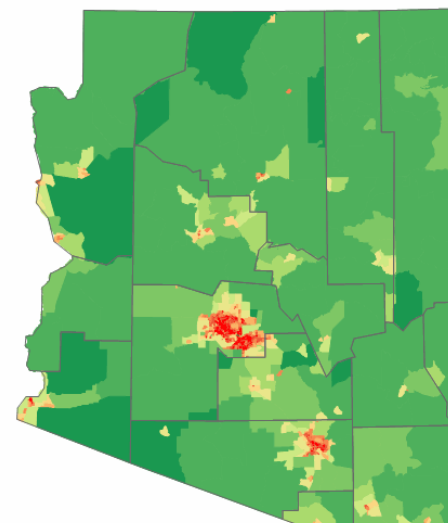
Population Change April 2010 to July 2011 AZ 1.4% USA 0.9%

The Arizona population can be characterized by high racial and geographic diversity.

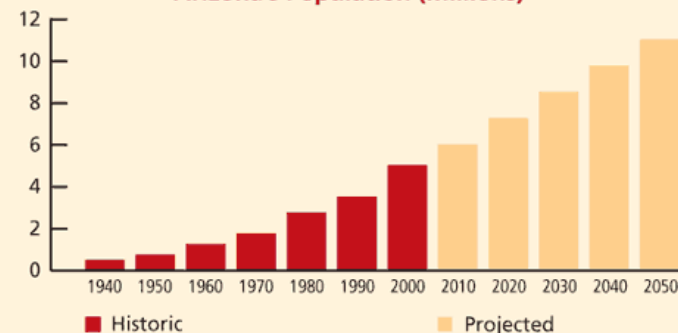
Differences in vaccine uptake occur geographically, and this is related to demographic heterogeneity across space.



Source: U. S. Census Bureau
Census 2000 Summary File 1
population by census tract.



Arizona's Population (Millions)



Source: U.S. Census Bureau and MoveAZ Plan Phase I Report (Cambridge Systematics, Inc., Lima & Associates, et. al., 2002).

Discussion – final remarks



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- Presentation of important population-level information about changes in vaccine coverage in Arizona in response to a new statewide meningococcal vaccination mandate.
- Make use of the ASIIS, a rich and valuable data source, and used novel methods that allowed for flexible analyses of changes to coverage estimates.
- Identified demographic characteristics of populations that may be less likely to respond to state mandates for vaccinations.
- Methods we used may be useful to other immunization programs in which similar initiatives and rules may be under consideration,

Future Directions



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- Examine additional factors such as:
 - the year the child entered sixth grade
 - provider demographics,
 - child's school (school districts),
 - differences in school practices regarding immunization requirements and exemptions
 - Account for children exempt from the immunization requirement (3,026 of 3,428 exemptions religious/philosophical)
- Provider factors:
 - School district-level and detailed demographic data on providers
 - exploration into other important areas that may influence immunization coverage.
- Explore factors responsible for denominator inflation observed in ASIIS (as compared to 2010 Census).



Acknowledgments

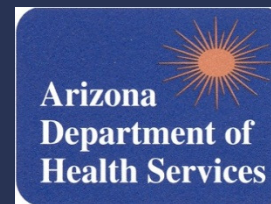


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Thank you! Questions?

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➤ Arizona State Department of Health Services, Immunization Program Office

- Patty Gast

Questions?

➤ AIRA

