Abstract

- Colorado has low pediatric vaccination rates for varicella, DTaP, and PCV13 relative to the rest of the US [3,4]. Low vaccination coverage is a risk for vaccine-preventable diseases (VPDs) in children and adults [2,7].
- We hypothesize that geographic areas with lower vaccination rates will show higher rates of corresponding VPDs and that newly available data from Colorado schools can be used to demonstrate and monitor a relationship, general scientific knowledge assures us that this relationship exists. Vaccines are known to decrease the rate of VPDs in a community [9].
- Univariate Spearman rho correlation analysis for association between select variables and case rates of varicella, pertussis, and pneumococcal disease among the 0-10 age group, 2016-2019

Introduction

- Colorado has low pediatric vaccination rates for varicella, DTaP, and PCV13 as compared to US as a whole [3,4,5].
- Gaps in vaccination coverage are a risk for vaccine-preventable disease (VPD) in both children and adults; vaccine exemptions are known to cluster geographically [8].
- Pediatric PCV13 vaccination has been shown to provide indirect protection to adults for invasive pneumococcal disease [1,6].
- Vaccination data collected in Colorado schools has only been publicly available as of 2016. If an association between vaccination rates and disease risk is found, these data could be a cost-effective way to look for Colorado disease prevention programs to monitor risk of VPDs.
- We hypothesized that existing secondary data sources could be used to demonstrate and monitor a relationship between vaccination rate and VPD incidence.

Methods

- Used available data from the Colorado Department of Public Health and Environment (vaccinations) and the Colorado Hospital Association (VPDs).
- Excluded counties with < 5 VPD cases (CDPHE restriction).
- Vaccination rates for varicella, DTaP, and PCV13 were compared to corresponding VPD incidence rates for both geographic (county-level) and temporal relationships.
- Spearman correlations were initially used, followed by both univariate and multivariable modeling.
- Other independent variables assessed include kindergarten population, population density, hospital density

Results

- Univariate Spearman rho correlation analysis for association between select variables and case rates of pneumococcal disease among the 20-29 age group, 2016-2019
- Univariate and multivariable linear regression model results for case rates of varicella, pertussis, and pneumococcal disease among the 20-10 age group, 2016-2019

Limitations

- We included a significant number of counties with very low case numbers over 4 years, limiting detectable effect
- We have overestimated VPD incidence when determining the power needed to detect a significant difference. Our use of existing secondary data and censoring of counties with < 5 cases limited this study's power
- Secondary data sources may be limited by inconsistent coding for VPDs and inconsistencies in school-based record keeping.
- Confounders not accounted for, including geographic clustering of presentation for VPDs based on access to care, could have affected results and measured outcome. Vaccination status is known to cluster similarly [8]. Lester population areas might be more impacted by this clustering, even while accounting for population density and total population.
- We did not account for children or adult vaccinations, which also give some degree of protection from VPDs

Conclusions

- Longitudinal presentation of these data identified fluctuating vaccination rates in Colorado, in addition to increasing cases of pneumococcal disease.
- Our modeling either did not reveal significant associations between vaccination and disease incidence or identified associations that were not meaningful in context, even accounting for confounders.
- Despite this study not demonstrating our hypothesized relationship, general scientific knowledge assures us that this relationship exists. Vaccines are known to decrease the rate of VPDs in a community [9].
- School-based vaccination data may still prove useful for public health purposes, but future investigations may consider alternative uses in addition to prospective data collection. This research could be used as a communication tool and highlight the importance of local data collection to key community members.

References


Figure 1: Number of cases by disease, time period, and age group. (A) Varicella, (B) Pertussis, (C) Pneumococcal disease

Figure 2: Vaccination Rates Over Time (2016-2019)