Assessing Measles Vaccination Coverage and Income in Orange County, California

Background

Measles is a highly contagious respiratory disease that can be prevented with the MMR (measles, mumps, and rubella) vaccine. Although health officials declared that measles had been eliminated in the U.S. since 2000, an outbreak that started in Orange County, California in December 2014 brought attention to state policy that allows unvaccinated students to enroll in schools.

Students are required to complete both doses of the MMR vaccine, but parents can choose to submit a personal beliefs exemption or medical exemption in order to avoid vaccination. During the 2013-2014 school year, there were 1,000 medical exemptions filed in California. While private health care covers the cost of the MMR vaccine, families with public health care may experience more barriers to the vaccine which include the time and cost associated with completing both doses. In order to assess what drives MMR vaccination coverage, household income is analyzed as a potential variable causing the disparity in immunization levels among kindergarten students.

Methodology

MMR vaccination rates of kindergarten students in elementary schools were divided into the following four categories:
- High Coverage (> 95% vaccinated)
- Medium High Coverage (90 – 94.9% vaccinated)
- Medium Low Coverage (85 – 89.9% vaccinated)
- Low Coverage (26.5 – 84.9% vaccinated)

Family income in the past 12 months was divided into the following three categories:
- Low Income Household (Less than $10,000 – $34,999)
- Medium Income Household ($35,000 – $74,999)
- High Income Household ($75,000 – $200,000 or more)

Results

<table>
<thead>
<tr>
<th>Coverage Group</th>
<th># of Schools</th>
<th># of Block Groups</th>
<th># of Low Income Households</th>
<th># of Medium Income Households</th>
<th># of High Income Households</th>
<th>Total # of Households</th>
<th>% Low Income</th>
<th>% Medium Income</th>
<th>% High Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 95%</td>
<td>54</td>
<td>236</td>
<td>32,848</td>
<td>33,187</td>
<td>37,719</td>
<td>103,754</td>
<td>31.7</td>
<td>32.0</td>
<td>36.4</td>
</tr>
<tr>
<td>90-94.9%</td>
<td>22</td>
<td>93</td>
<td>13,757</td>
<td>14,798</td>
<td>16,683</td>
<td>45,238</td>
<td>30.4</td>
<td>32.7</td>
<td>36.9</td>
</tr>
<tr>
<td>85-89.9%</td>
<td>15</td>
<td>77</td>
<td>11,477</td>
<td>12,116</td>
<td>13,140</td>
<td>36,733</td>
<td>31.2</td>
<td>33.0</td>
<td>35.8</td>
</tr>
<tr>
<td>26.5-84.9%</td>
<td>17</td>
<td>78</td>
<td>10,006</td>
<td>10,474</td>
<td>11,667</td>
<td>32,147</td>
<td>31.1</td>
<td>32.6</td>
<td>36.3</td>
</tr>
</tbody>
</table>

Discussion and Limitations

Across the four MMR coverage groups, there does not appear to be a significant difference between the percentages of households in the High, Medium, and Low Income groups (Figure 3). 50% of elementary schools in this model fell in the high coverage category and are considered to be protected from a measles outbreak.

Limitations to the Data: Only 108 elementary schools were captured in this model despite other elementary schools being present within the 19 school districts. Schools were omitted because their names from the PBS&J data did not match school names from the California Department of Public Health or because they did not report MMR vaccination rates. If schools are failing to report their vaccination data in order to avoid being identified as an unsafe school, this model underestimates the number of schools with less than 95% coverage. In order to improve the model, a larger data set that includes more schools and more school districts across the state of California should be tested.

Limitations to the Model: This model assumes that a 0.5 mile buffer around schools will capture all of its students and their households in order to determine their income. The block groups selected must have their center within the buffer which excludes some larger block groups that surround the school. In order to capture more information within a buffer, the model could use census block data.

Conclusion

Based on the results of this model, household income does not explain the large variation in MMR vaccination rates among kindergarten students in 108 elementary schools in 19 California school districts. Other factors such as health care coverage could be further explored in order to determine why kindergarten students are unvaccinated. These results could be a significant help in designing public health interventions that aim to increase vaccination coverage in elementary schools and reduce the number of public health interventions to the next measles outbreak.

Table 1. Summary of the results of the model. From the block groups located within each buffer category, the percentage of households that fall in the Low Income, Medium Income, and High Income groups were calculated in order to compare across the different MMR vaccine coverage groups.

Sources

- California School Districts: California Department of Public Health, 2015-2016 California School Districts. Other factors such as health care coverage could be further explored in order to determine why kindergarten students are unvaccinated. These results could be a significant help in designing public health interventions that aim to increase vaccination coverage in elementary schools and reduce the number of public health interventions to the next measles outbreak.