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CHART

Center for Health Analytics, Research & Transformation at NJHA

LACK OF IMMUNIZATIONS SPREADS DISEASE THREAT ACROSS NEW JERSEY

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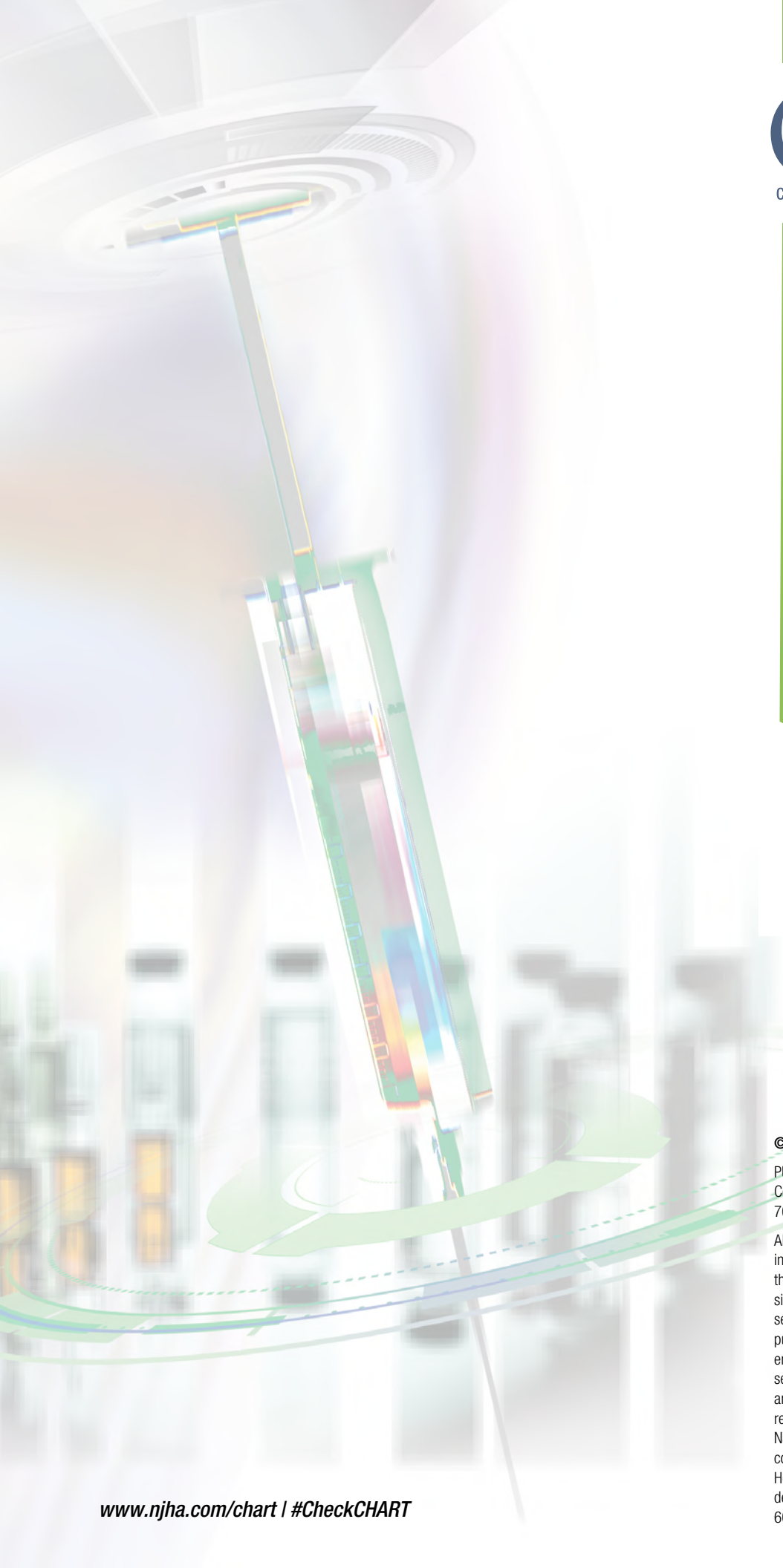

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LACK OF IMMUNIZATIONS SPREADS DISEASE THREAT ACROSS NEW JERSEY

In 2018 a disease that was declared eradicated in the United States 18 years previously began making headlines again, with New Jersey at the forefront. By year end, the Centers for Disease Control and Prevention (CDC) would confirm 372 cases of measles across the county, with New Jersey accounting for 10 percent of the national total.[1,2] Through seven months of 2019, more than 1,100 individual cases[1] of measles have been confirmed in 30 states, representing the greatest number of reported cases in the U.S. since 1992 (2,237 cases) and since measles was declared eliminated in 2000.[3,4] With August marking National Immunization Awareness Month, the Center for Health Analytics, Research and Transformation (CHART) at NJHA takes a closer look at the prevalence and current implications of measles, influenza and other vaccine-preventable diseases – a growing epidemic which adds billions of dollars to the U.S. healthcare system annually.

Vaccine-Preventable Diseases

In 1954, a blood sample taken from a 13-year-old boy infected with measles was collected by physicians at Boston Children's Hospital in an attempt to isolate the virus responsible for the deadly disease.[4] Once isolated, this strain of the measles virus was systematically weakened through a process called culturing. Nearly a decade later, the virus was transformed into the first measles vaccine licensed for use in the United States.

The vaccine – included in MMR (measles, mumps, and rubella) or MMRV (measles, mumps, rubella, and varicella) – was improved upon in 1968 and has been the only measles vaccine used in the U.S. ever since.[4] It is now considered to be one of the most effective childhood vaccines in use throughout the world today, with two doses being about 97 percent effective at preventing measles.[5] The measles vaccine proved so effective that the disease was declared eliminated, first in the United States in 2000, then throughout the entire North American continent in 2015. [4,6]

While measles has grabbed headlines over the past year, the role that vaccines play does not end at childhood. Numerous other vaccine-preventable diseases continue to impact the health of individuals and communities across the country and around the globe.

Despite being one of the most cost-effective and safest forms of preventive medicine, recent outbreaks in developed countries of vaccine-preventable diseases such as measles, pertussis (whooping cough), and mumps, have contributed to the resurgence of vaccinations, or more specifically lack thereof, as a top-tier public health issue.

Through seven months of 2019, more than 1,100 individual cases of measles have been confirmed in 30 states, representing the greatest number of reported cases in the U.S. since 1992 (2,237 cases) and since measles was declared eliminated in 2000.

Many individuals, particularly adults, are not receiving vaccinations at the levels recommended by the CDC. A May 2018 survey of U.S adults found that from 2008 to 2018, the proportion of respondents who consider vaccines "very important" to the health of society decreased nearly 13 percent.[7] In addition, the percentage that is "somewhat confident" in the current healthcare system's ability to evaluate the safety of vaccines decreased 15 percent.

This decline in the public trust concerning vaccine safety has consequences that extend beyond the health of the individual or the community. The financial burden that unvaccinated individuals place on the economy is particularly striking. In a November 2016 study in *Health Affairs* – one of the most comprehensive of its kind to date – researchers focused on the economic burden of diseases associated with 10 vaccines offering protection against 14 different pathogens recommended by the CDC for U.S adults in 2015. [8]

They estimated the total financial burden from these vaccine-preventable diseases to be around $9 billion annually. Ninety-five percent of the total estimated burden was associated with direct costs including hospital inpatient and outpatient treatment costs and medication costs, while the remaining 5 percent represented productivity losses as a result of wages lost during the course of treatment.[8]

Influenza – the common flu – was found to be the costliest among the 14 vaccine-preventable diseases included in the study, accounting for $5.8 billion, or 65 percent, of the total economic burden. Pneumococcal disease, a bacterial infection *(Streptococcus pneumoniae)* that can cause pneumonia, meningitis, sepsis, and other serious illnesses, was the next most costly at nearly $1.9 billion or 21 percent of the total.[8]

Perhaps the most compelling finding was that a vast majority – approximately 80 percent – of the economic burden was

attributable to unvaccinated adults. More than $7 billion of the $9 billion in total costs were the result of adult individuals who received no direct protection from vaccination.[8]

In this white paper, CHART spotlights three vaccine-preventable diseases: measles, influenza, and pneumococcal disease. CHART summarizes available data to present county-level case counts and rates per 100,000 population for each of the selected diseases for the most recent five-year period (2014 to 2018). In addition, data from the Annual Immunization Status Reports (ASR) is examined to document the recent increase in the percentage of children granted religious exemptions from the mandatory immunization requirements for school attendance in New Jersey.

Rather than providing a comprehensive overview of vaccine-preventable diseases or vaccination rates in New Jersey, CHART focused its efforts on providing a snapshot of these three common vaccine-preventable diseases and recent trends in childhood vaccinations throughout the state in order to inform not only the general public, but those participating in the discourse around vaccines at the national, state and local levels, which may have broad consequences for public health for years to come.

Measles

Measles is a viral infection that is highly contagious. It is easily spread through the air when an infected individual sneezes or coughs and can linger and remain infectious in an enclosed space for up to two hours after an infected person has left.[9]

The MMR or MMRV vaccines are considered by the CDC to be safe and effective. Two doses of the MMR vaccine are about 97 percent effective at preventing measles.[5]

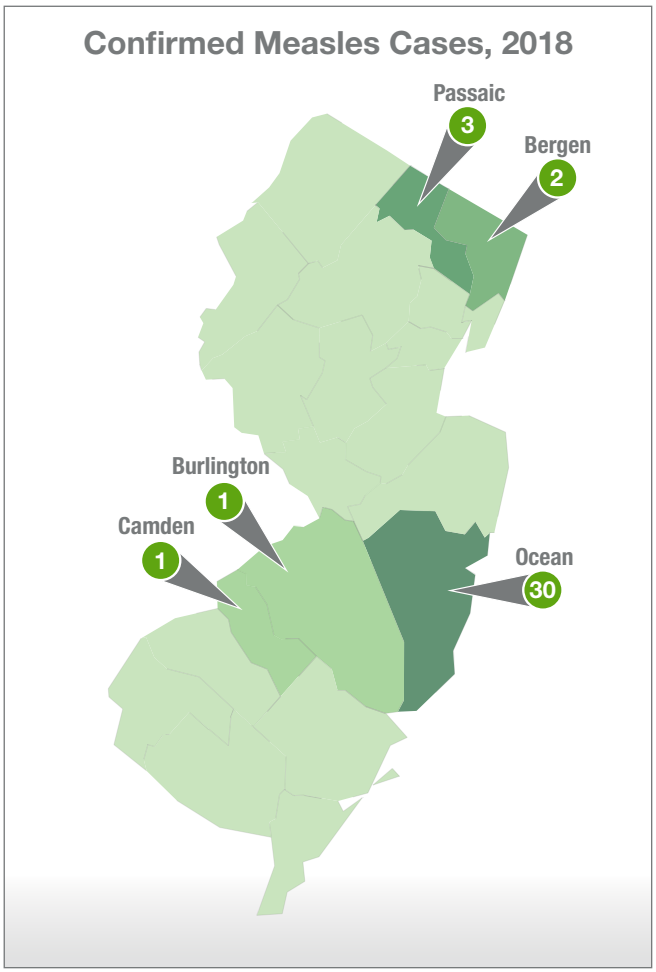
While vaccines have made these diseases much less common in the United States, measles, in particular, experienced a significant increase in the number of reported cases beginning in 2018 and accelerating through year-to-date 2019.

According to the most recent national data from the CDC, from Jan. 1 to Aug. 15, 2019, 1,203 individual cases of measles have been confirmed in 30 states, including New Jersey. This seven-month running total is already more than three times the number of cases reported in all of 2018, and more than double the combined cases reported in the three preceding years (372 cases in 2018, 120 in 2017, and 86 cases in 2016, for a three-year total of 578 cases).[1]

Despite the progress made in recent years toward eliminating this disease, New Jersey has experienced major outbreaks in 2018 and 2019. According to the N.J. Department of Health (NJDOH), 37 measles cases were confirmed in New Jersey in 2018.[2] Though New Jersey is the most densely populated state in the country, its population represents just 2.7 percent of the national total. The 37 confirmed cases of measles, however, represented 10 percent of the 372 cases reported nationwide last year.

As can be seen in the map below, the state's measles cases in 2018 were spread across five counties, with 30 of the 37 cases located in Ocean County.[2]

To date in 2019, Ocean County is again leading the state in the number confirmed measles cases. Per NJDOH, "As of August 16, 2019, there are 18 confirmed cases of measles in New Jersey. Twelve of these cases are associated with the 2019 Measles Outbreak, Ocean County, which was considered over as of May 16."[10] The Ocean County Outbreak actually consisted of 8 confirmed cases in Ocean County residents plus "4 cases in one Monmouth County household that had a direct epidemiologic link to the outbreak community."[11]



Influenza (Flu)

The flu (influenza) is a respiratory illness caused by the human influenza viruses. The two main types of influenza viruses that spread among people are Types A and B, and are the cause of seasonal flu epidemics.[12]

Per CDC estimates, approximately 3 to 11 percent of the U.S. population experiences a symptomatic flu illness each year, with an average around 8 percent.[13] Infected individuals are most contagious in the first three to four days after the illness begins. Individuals often experience symptoms around two days after infection and can remain contagious for up to five to seven days after that period.[13] The flu can be spread via tiny droplets, which are released when someone sneezes, coughs, or even talks.

Annual vaccinations remain the best way to prevent the flu, according to the CDC.

Flu season runs from October to May, with most cases being reported from late December to early March.[14] Like the flu itself, the vaccine is seasonal. Each year, the flu vaccine attempts to match, and therefore protect against, what the most common circulating influenza strains are predicted to be for the upcoming season. Due to this factor, its effectiveness varies season to season. The main cause of seasonal mutations in the influenza virus is antigenic drift, which involves relatively small genetic changes in the virus.[15] Per the CDC, the flu vaccine reduces the risk of influenza by 40 to 60 percent when the circulating flu viruses are well-matched to the flu vaccine.[16]

The 2017-18 influenza season in the United States was one of the most severe in recent memory. High rates of influenza during the 2017-18 season reflect the low vaccine effectiveness that season, which the CDC estimated at 38 percent.[17] By comparison, the preliminary effectiveness of the flu vaccine for the 2018-19 season is estimated at 47 percent.[17]

The CDC's own estimates of the burden associated with the last two flu seasons help demonstrate the severity of the 2017-18 season compared to 2018-19. The estimated burden due to influenza for the 2017-18 season included:

- 49 million flu illnesses
- 960,000 flu hospitalizations
- 79,000 flu deaths.[18]

By comparison, preliminary estimates for the 2018-219 flu season include the following:

- 37.4 to 42.9 million flu illnesses
- 531,000 to 647,000 flu hospitalizations
- 36,400 to 61,200 flu deaths.[19]

Serious flu complications can result in hospitalization or even death. Young children, the elderly, and individuals with certain health conditions are at a higher risk of serious complications. While those with the highest risk of developing serious complications from the flu include individuals age 65 and older, there is an increasing recognition for the need to account for the diversity within the elderly population in regard to health. Based on a study by the CDC, hospitalization rates for influenza among adults aged 85 years and older were two-to-six times higher compared to those aged 65-74 years.[20]

A look at claims data from New Jersey acute care hospitals supports the CDC's findings about the virulence of the 2017-18 flu season compared to that of the following year. On the inpatient side, hospitals throughout the state collectively discharged 61 percent more patients with an influenza-related primary diagnosis from Oct. 1, 2017, to March 31, 2018, than during the same six-month period in the subsequent year. This finding is consistent with the CDC's estimated number of hospitalizations due to influenza for these two flu seasons. The approximately 960,000 hospitalizations attributed to the 2017-18 flu season is 63 percent greater than the average (589,000) hospitalizations estimated by the CDC for 2018-19.[18]

N.J. Influenza Emergency Department Visits

	2017-18		2018-19	
	Cases	Percent of Total	Cases	Percent of Total
Age Group				
18 and Under	7,915	22.4%	6,860	25.4%
19-64	21,833	61.8%	16,185	59.9%
65 and Older	5,559	15.7%	3,976	14.7%
Total	35,307		27,021	

N.J. Influenza Inpatient Hospitalizations

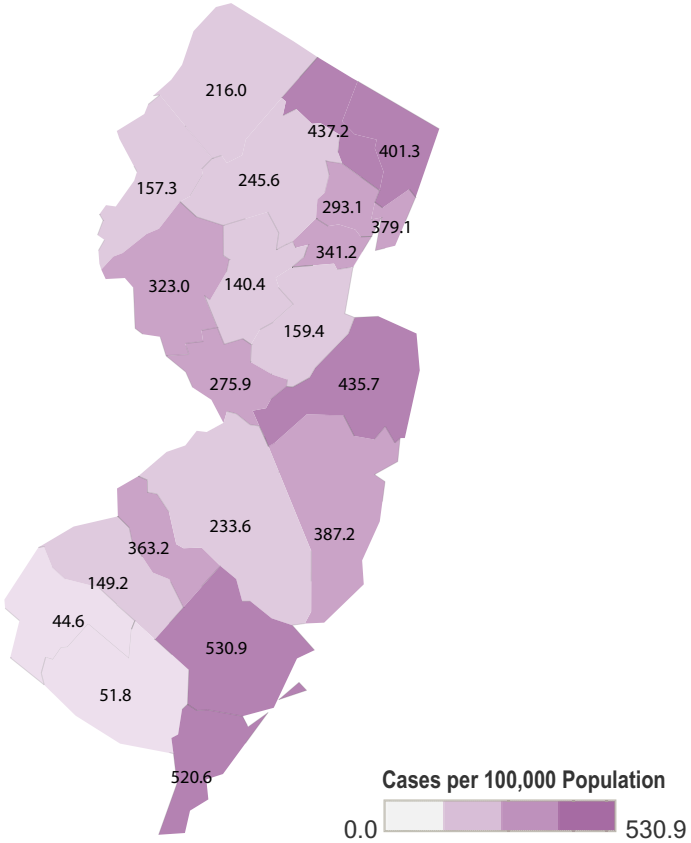
	2017-18		2018-19	
	Cases	Percent of Total	Cases	Percent of Total
Age Group				
18 and Under	257	6.5%	219	9.0%
19-64	1,153	29.3%	866	35.5%
65 and Older	2,522	64.1%	1,354	55.5%
Total	3,932		2,439	

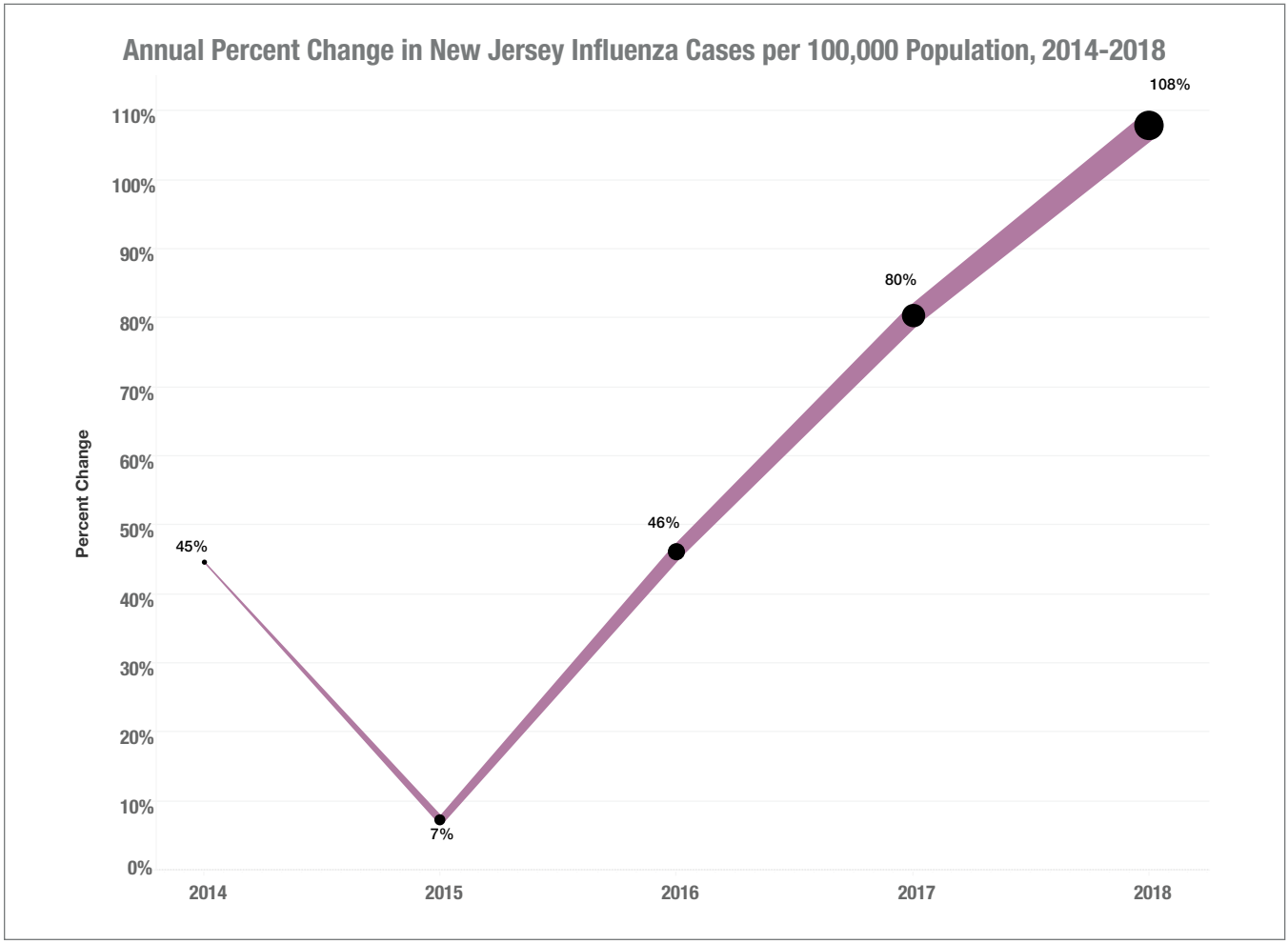
SOURCE: *NJ Hospital Discharge Data Collection System*

The flu, like many other diseases, presents greater risks from complications for elderly individuals. With that in mind, CHART analyzed the New Jersey hospital discharge data by age group. Not surprisingly, patients 65 years and older comprised more than 55 percent of inpatient influenza cases for the 2018-19 flu season and 64 percent of inpatients for the 2017-18 season. Again, this finding parallels results at the national level, including the CDC's finding that between 50 and 70 percent of seasonal flu-related hospitalizations have occurred among people 65 years and older.[21]

While being most dangerous to the elderly and the young, the flu also inflicted New Jersey's healthiest component of society. In 2017-18, an unanticipated number of individuals between the ages of 19 and 64 visited New Jersey hospital emergency departments seeking treatment for the flu. Compared to the following year, emergency department visits for influenza-related diagnoses were 31 percent higher during the 2017-18 season. However, unlike the inpatient activity, patients seeking care at emergency departments and not subsequently admitted to the hospital were predominantly younger. The cohort between the ages of 19 and 64 comprised 62 percent of all total influenza-related emergency department visits for the 2017-18 season and 60 percent of the total the next flu season.

Influenza Cases per 100,000 Population, 2018





The rate of influenza per 100,000 population has grown significantly in recent years. The most recent data available shows the influenza rate per 100,000 population more than doubling from the prior year – from 152.7 cases per 100,000 population in 2017 to 317.4 in 2018.[3,22]

Pneumococcal Disease

Pneumonia can be caused by a variety of viruses, bacteria, and fungi.[23] Pneumonia can have severe health effects, leading to hospitalization and even death among the elderly and other at-risk populations. Per the CDC, an estimated 1 million people seek care in hospitals for pneumonia, of all causes, with approximately 50,000 dying from the disease each year.[24]

The most common cause of pneumonia is the bacteria *Streptococcus pneumoniae,* or pneumococcus, which can also lead to other forms of pneumococcal disease ranging from ear and sinus infections to potentially life-threatening meningitis and bloodstream infections.[25] Pneumonia is the most common form of pneumococcal disease in adults.[26]

There are two types of vaccines – pneumococcal conjugate and pneumococcal polysaccharide – both of which help protect against pneumococcal disease, including pneumonia.[27] One dose of the conjugate vaccine protects around 45 in 100 adults age 65 and older against pneumonia, while one dose of either

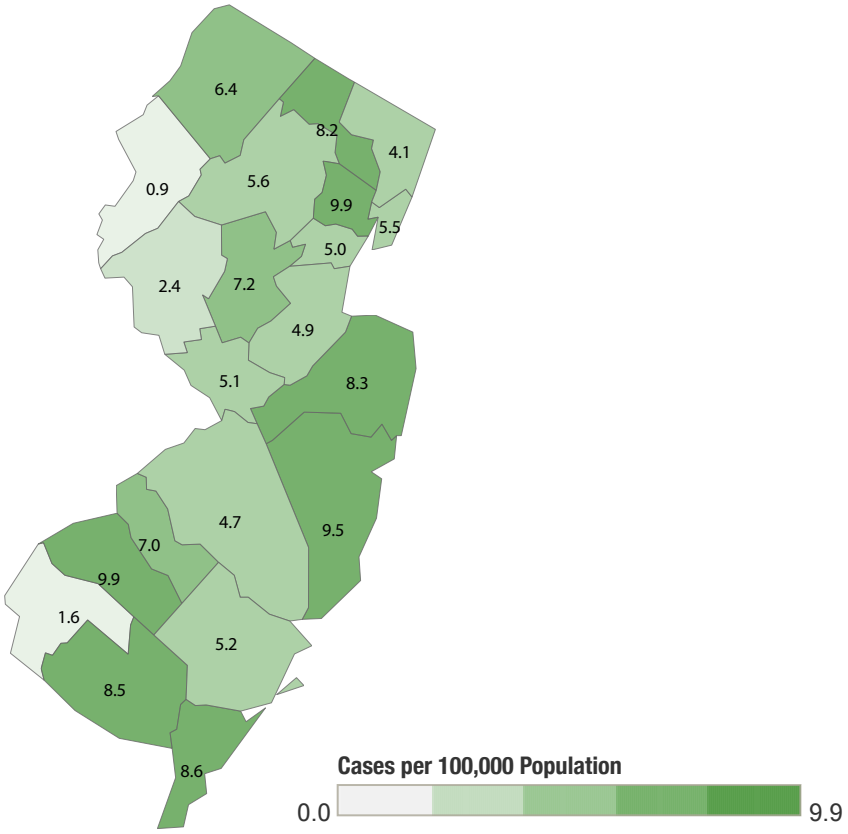
vaccine protects 50 to 85 percent of adults against invasive pneumococcal disease.

Despite its ability to cause serious illness, accurately identifying pneumococcal pneumonia is challenging for clinicians. Conventional methods of identification are relatively slow and show limited specificity. In addition, *Streptococcus pneumoniae* bacteria can colonize the upper respiratory tract without causing a symptomatic infection.[28,29]

A review of New Jersey claims data helps to highlight just how high the proportion of pneumonia cases with an "unidentified" cause is in hospital settings. In 2018, New Jersey hospital claims included 194 inpatient admissions and 30 emergency department visits that were specifically coded with a primary diagnosis of "pneumonia due to *Streptococcus pneumoniae.*" However, the vast majority of pneumonia-related cases in both settings were coded with the broader "pneumonia, unspecified organism." Of the total all-cause pneumonia cases in 2018, 13,012 inpatient admissions (76.7 percent) and 15,262 emergency department visits (75.4 percent) were coded as unspecified.

Statewide rates for overall pneumococcal disease have increased slightly from 2014 to 2018, but in general are relatively stable.[3,22] The most noticeable spike occurred in 2017 when the rate of *Streptococcus pneumoniae* jumped to 7.7 cases per 100,000 population from 6.5 in the prior year. While not confirmed, the particularly virulent flu season may have had an impact on the increase in the pneumococcal disease rate.

Streptococcus Pneumoniae Cases per 100,000 Population, 2018



Exemptions from Vaccinations

The best way to prevent transmission of measles, influenza, pneumonia, and many other vaccine-preventable diseases is through increased immunization rates. Unfortunately, recent data shows such rates decreasing among children attending New Jersey schools.

State regulations (N.J.A.C. 8:57-4) detail the minimum required number of vaccine doses children must have in order to enter, attend, or transfer into a New Jersey-licensed school, including child care and preschool. The regulations also allow for exemptions from these mandatory immunizations for medical or religious reasons.

A review of the Annual Immunization Status Reports (ASR) data from NJDOH for the past five years shows an increase in the percent of children with religious exemptions.[30] Among all schools in New Jersey for the 2013-2014 school year, the statewide percentage of children claiming a religious exemption from the mandatory vaccinations was 1.7 percent, or approximately 17 out of every 1,000 pupils. By the 2018-2019 school year, the percent had increased to 26 pupils per 1,000 – an increase of nearly 53 percent.

Diseases like smallpox and polio are no longer common scourges because of their complete or near elimination through vaccination.

A Call to Action

As the state sees increased rates of measles, influenza, and pneumonia, the good news is there are concrete actions that can – and should—be taken to reduce the harm caused by vaccine-preventable diseases.

CHART endorses evidence-based recommendations, summarized by NJHA's Director of the Institute for Quality and Patient Safety Shannon Davila, a registered nurse and infection prevention specialist.

Davila states, "The Centers for Disease Control and Prevention, the American Academy of Pediatrics and the American Academy of Family Physicians all agree on a schedule of immunizations. The recommended vaccines for infants include MMR… polio, varicella (or chickenpox) and hepatitis B, among others. Older kids should add meningitis and human papillomavirus vaccines to the list. And all of us – kids to senior citizens – should receive an annual flu shot."[31]

In addition to adhering to the recommended vaccination schedule, other ways the general public can protect themselves and vulnerable communities from preventable infections include:[31]

- Receiving any additional vaccinations or booster-shots recommended before international travel.
- Wash hands well and often, especially after using the restroom, before and after eating, touching surfaces in a public place, and when visiting with people who may have weaker immune systems, including very young children and the elderly.[32]

- Consult with a primary care provider on vaccination history. Depending on date and place of birth, previous recommendations for vaccination of different age cohorts may have been updated.

Vaccinations are one of the most studied and effective healthcare interventions. Diseases like smallpox and polio are no longer common scourges because of their complete or near elimination through vaccination.[33,34] Measles was once considered eradicated from North America; with greater public awareness and better adherence to evidence-based vaccination recommendations, it may once again be banished to medical history.

Footnotes:

1. Measles Cases and Outbreaks | CDC. Retrieved August 16, 2019 from https://www.cdc.gov/measles/cases-outbreaks.html
2. 2018 New Jersey Reportable Communicable Disease Report. Retrieved from https://www.state.nj.us/health/cd/documents/reportable_disease/2018webstatistics.pdf
3. Epidemiology and Prevention of Vaccine-Preventable Diseases | CDC: Appendix E (full set). Retrieved from https://www.cdc.gov/vaccines/pubs/pinkbook/downloads/appendices/appdx-full-e.pdf
4. Measles | History of Measles | CDC. Retrieved from https://www.cdc.gov/measles/about/history.html
5. MMR Vaccination | What You Should Know | Measles, Mumps, Rubella | CDC. Retrieved from https://www.cdc.gov/vaccines/vpd/mmr/public/index.html#what-is-mmr
6. Mitchell, C. (2016, September 27). PAHO/WHO: Measles elimination in the Americas. Retrieved from https://www.paho.org/hq/index.php?option=com_content&view=article&id=12526:measles-elimination-in-the-americas&Itemid=40721&lang=en
7. Americans' Views on Vaccines and Infectious Disease Outbreaks | Research America. Retrieved from https://www.researchamerica.org/sites/default/files/MAY2018_VaccinePressRelease_final.pdf
8. Mclaughlin, J. (2013). Estimated Human and Economic Burden of Four Major Adult Vaccine-Preventable Diseases in The United States, 2010. Value in Health, 16(3). Retrieved from https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2016.0462?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub=pubmed&
9. Top 4 Things Parents Need to Know about Measles | CDC. Retrieved from https://www.cdc.gov/measles/about/parents-top4.html
10. New Jersey Department of Health, Communicable Disease Service. Retrieved August 16, 2019, from https://www.state.nj.us/health/cd/topics/measles.shtml
11. New Jersey Department of Health, Communicable Disease Service | Measles Archive. Retrieved from https://www.state.nj.us/health/cd/topics/measles_archive.shtml#3
12. Types of Influenza Viruses | CDC. Retrieved from https://www.cdc.gov/flu/about/viruses/types.htm
13. Key Facts About Influenza (Flu) | CDC. Retrieved from https://www.cdc.gov/flu/about/keyfacts.htm
14. The Flu Season | CDC. Retrieved from https://www.cdc.gov/flu/about/season/flu-season.htm
15. How the Flu Virus Can Change: "Drift" and "Shift" | CDC. Retrieved from https://www.cdc.gov/flu/about/viruses/change.htm
16. Vaccine Effectiveness: How Well Do the Flu Vaccines Work? | CDC. Retrieved from https://www.cdc.gov/flu/vaccines-work/vaccineeffect.htm
17. Past Seasons Vaccine Effectiveness Estimates | CDC. Retrieved from https://www.cdc.gov/flu/vaccines-work/past-seasons-estimates.html
18. Estimated Influenza Illnesses, Medical visits, Hospitalizations, and Deaths in the United States - 2017–2018 influenza season | CDC. Retrieved from https://www.cdc.gov/flu/about/burden/2017-2018.htm
19. 2018-2019 U.S. Flu Season: Preliminary Burden Estimates | CDC. Retrieved from https://www.cdc.gov/flu/about/burden/preliminary-in-season-estimates.htm
20. Study Shows Hospitalization Rates and Risk of Death from Seasonal Flu Increase with Age. Retrieved from https://www.cdc.gov/flu/spotlights/2018-2019/hopitalization-rates-older.html
21. People 65 Years and Older & Influenza | CDC. Retrieved from https://www.cdc.gov/flu/highrisk/65over.htm
22. Health, D. of. New Jersey State Health Assessment Data New Jersey's Public Health Data Resource. Retrieved from https://www-doh.state.nj.us/doh-shad/query/builder/commdis/CommDis/Count.html
23. Causes of Pneumonia | CDC. Retrieved from https://www.cdc.gov/pneumonia/causes.html
24. Pneumonia Can Be Prevented-Vaccines Can Help | CDC. Retrieved from https://www.cdc.gov/pneumonia/prevention.html
25. Pneumococcal Disease | Types of Infection | CDC. Retrieved from https://www.cdc.gov/pneumococcal/about/infection-types.html
26. Pneumococcal Disease | Facts About Pneumonia | CDC. Retrieved from https://www.cdc.gov/pneumococcal/about/facts.html
27. Pneumococcal Vaccination | What You Should Know | CDC. Retrieved from https://www.cdc.gov/vaccines/vpd/pneumo/public/index.html
28. Amanda, G., Sutoyo, D. K., & Burhan, E. (2019). Pneumococcal pneumonia and invasive pneumococcal disease: Immunopathogenesis and diagnosis. *Pneumologia, 68* (1), 8-14. doi:10.2478/pneum-2019-0009
29. Song, J. Y., Eun, B. W., & Nahm, M. H. (2013). Diagnosis of Pneumococcal Pneumonia: Current Pitfalls and the Way Forward. *Infection & Chemotherapy*, 45(4), 351. doi:10.3947/ic.2013.45.4.351
30. New Jersey Department of Health, Communicable Disease Service | Immunization Status/Exemption Reports. Retrieved from https://www.nj.gov/health/cd/statistics/imm-status-reports/#1
31. Moms and dads: Do this one thing to protect your children | New Jersey Hospital Association. Retrieved from http://www.njha.com/nurse-talk/2019-nurse-talk-articles/moms-and-dads-do-this-one-thing-to-protect-your-children/
32. Wash the Right Way: Clean Hands Save Lives | New Jersey Hospital Association. http://www.njha.com/media/332104/washtherightwayweb.gif
33. Emergencies preparedness, response | Smallpox | World Health Organization. Retrieved from https://www.who.int/csr/disease/smallpox/en/
34. Polio | U.S. Polio Elimination | CDC. Retrieved from https://www.cdc.gov/polio/us/index.html

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