Life Course Indicator: Children Receiving Age Appropriate Immunizations

The Life Course Metrics Project

As MCH programs begin to develop new programming guided by a life course framework, measures are needed to determine the success of their approaches. In response to the need for standardized metrics for the life course approach, AMCHP launched a project designed to identify and promote a set of indicators that can be used to measure progress using the life course approach to improve maternal and child health. This project was funded with support from the W.K. Kellogg Foundation.

Using an RFA process, AMCHP selected seven state teams, Florida, Iowa, Louisiana, Massachusetts, Michigan, Nebraska and North Carolina, to propose, screen, select and develop potential life course indicators across four domains: Capacity, Outcomes, Services, and Risk. The first round of indicators, proposed both by the teams and members of the public included 413 indicators for consideration. The teams distilled the 413 proposed indicators down to 104 indicators that were written up according to three data and five life course criteria for final selection.

In June of 2013, state teams selected 59 indicators for the final set. The indicators were put out for public comment in July 2013, and the final set was released in the Fall of 2013.

Basic Indicator Information

Name of indicator: Children receiving age-appropriate immunizations (LC-35)

Brief description: Percent of children ages 19-35 months receiving age-appropriate immunizations according to the Advisory Committee for Immunization Practices (ACIP) guidelines and HP 2020 Goal.

Indicator category: Health Care Access and Quality

Indicator domain: Service/Capacity

Numerator: Number of children surveyed who received ≥four doses of DTaP/DT/DTP (Diphtheria/Tetanus/Acellular pertussis), ≥three doses of poliovirus vaccine, ≥one doses of measles-containing vaccine, full series of Hib (Haemophilus influenza - three or four doses, depending on product type), ≥three doses of HepB (Hepatitis B), ≥one dose of varicella vaccine, and >= four PCV (Pneumococcal) doses. 4:3:1:3:3:1:4 series

Denominator: Number of children age 19-35 months

Potential modifiers: The following modifiers are available at the state level for the National Immunization Survey: Milestone Age; Poverty Status (at or above the federal poverty level vs. below the federal poverty level); Urbanicity (living in a Metropolitan Statistical Area [MSA] central city vs. MSA non central city vs. non-MSA central city); race (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic American Indian (AI) or Alaska Native (AN), non-Hispanic Asian, non-Hispanic Native Hawaiian or other Pacific Islander, and non-Hispanic Multiple Race); Provider Facility Type (Public, Private, Mixed, or Other); and Vaccines for Children Facility Participation (yes or no).

Data source: National Immunization Survey (NIS)

Notes on calculation: The numerator is the 4:3:1:3:3:1:4 vaccine series as reported by the NIS. The survey data are weighted to represent the U.S. population of children age 19-35 months.

Similar measures in other indicator sets: HP 2020 Focus areas IID-1, IID-7, IID-8 (Leading Health Indicator), IID-9; Title V Performance Measure #07; NQF measure 0038; MIECHV Benchmark Area Improved Maternal and Newborn Health: Well-Child Visits; United Health Rankings Core Measure

Life Course Criteria

Introduction

The prevention of disease and its spread is critical to ensuring the public's health. Vaccine-preventable diseases have a costly impact, including medical visits, hospitalizations, long-term disability or adverse health outcomes, and possible death.[3] Early vaccinations against serious and crippling diseases, administered when children are most vulnerable, can protect children against illness, lifetime adverse health effects, and even early death. In the past century, life expectancy has increased by more than 30 years and mortality for most childhood vaccine-preventable diseases has decreased by 99 percent.[4] Furthermore, immunizing individual children can help protect the health of communities at large, including children who are too young to be vaccinated. Vaccinations can also improve health outcomes for future generations by limiting the spread of disease and potentially ending serious side effects of certain diseases.[5]

Properly immunizing infants and children against serious infectious diseases helps both the individual child (critical and sensitive period) and future generations (over time), which is consistent with life course science. With regard to communication and explanation of the indicator, in general, vaccines are accepted as a safe and effective way to protect the health of young children. However, in recent years there has been an increase in the number of parents refusing to vaccinate their children, citing fears of the adverse effects of vaccination (in many cases based upon faulty science) and questioning its value, given the reduction and elimination of vaccine-preventable diseases in the United States. While the number of parents refusing vaccines is quite small, it poses a threat to communities, and communicating and upholding the value of vaccination will remain a public health challenge in the years to come.

Implications for equity

Disparities in childhood immunizations have been found among those populations affected by poverty and low socio-economic status. The NIS allows for comparison of childhood immunization rates by race/ethnicity and by poverty status (at or above the federal poverty level or below the federal poverty level). In the most recent survey results (2011), immunization coverage, or estimates of the number of people who have received particular vaccines, differs by poverty level. The Vaccines For Children program was created to provide vaccinations to financially vulnerable children and has helped eliminate differences for particular vaccines; however, immunization coverage rates among children living below poverty are still lower than those for children living at or above the poverty level for newer vaccines (e.g., pneumococcal conjugate vaccine and rotavirus vaccine) and vaccines that require four doses to complete the series.

Additionally, there is some evidence that race and ethnicity may have implications for equity in childhood immunizations. The recent NIS data indicate that American Indian/Alaska Native (AI/AN) children have lower immunization coverage compared with white children for many vaccines. Immunization coverage among AI/AN children decreased from 81.8 percent in 2010 to 72.7 percent in 2011 for ≥ four doses of DTaP, and from 85.3 percent to 75.3 percent for ≥ four doses of PCV (Pneumococcal conjugate vaccine). While immunization coverage rates vary among other racial and ethnic groups, few differences were observed after adjusting for poverty status. For example, differences in immunization coverage between white and black children could be explained by a higher prevalence of poverty among black children. Immunization coverage among children in all other racial/ethnic groups was similar to or higher than immunization coverage among white children for most vaccines after adjusting for poverty.[1]

Public health impact

Vaccines have been shown to be one of the most cost-effective clinical preventive services, and childhood immunization programs provide a very high return on investment. Per Healthy People 2020, "for each birth cohort vaccinated with the routine immunization schedule (this includes DTap, Td (Tetanus-Diphtheria), Hib, Polio, MMR (Measles/Mumps/Rubella), Hep B, and varicella vaccines), society:

- Saves 33,000 lives.
- Prevents 14 million cases of disease.
- Reduces direct health care costs by $9.9 billion.

- Saves $33.4 billion in indirect costs."[6]

Immunizations help protect the health of a community, especially those people who cannot be immunized such as children who are too young for particular vaccines (e.g., measles vaccine cannot be given to a child less than one year), cannot be immunized for medical reasons (e.g., children with leukemia), or cannot make an appropriate immune response to the vaccine.[7] Medical and religious exemptions to school immunization requirements are allowed in most states (medical in all states, and religious in most states), thus making it important for health departments and schools to work together to maintain high immunization coverage rates.[8] While the incidence of most vaccine-preventable diseases remains at historically low levels in the United States, recent outbreaks, such as measles and pertussis, highlight the public health costs and need to maintain high rates of immunization.[9,10]

Vaccine-preventable diseases also can have additional social and economic costs, including missed school days for children and lost work time for parents; medical costs from doctor's visits, medications and hospitalizations; and premature death.[11] The return on investment and maintenance of herd immunity signifies that an increase in the indicator of age-appropriate immunizations is vitally important for the continued preservation and protection of childhood, family, and community health.

Leverage or realign resources

To maintain high immunization coverage rates, the Centers for Disease Control and Prevention (CDC) encourages the use of evidence-based methods, which include the following components:

- parent and provider reminders
- reducing out-of-pocket costs
- standing orders
- home visits to vulnerable populations
- vaccination requirements for child care centers
- use of immunization information systems
- vaccination programs in child care centers and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) settings[1]

These components lend themselves to traditional public health partnerships (e.g., among providers, immunization programs, WIC programs, and home visiting programs), but also suggest collaborations among new partners such as child care centers and community organizations.

Under the Affordable Care Act (ACA), health plans are required to cover recommended immunizations without cost to the enrollee when administered by an in-network provider. ACA also reauthorizes the Section 317 Immunization Grant Program, which provides availability of federally purchased vaccines and grants to all 50 states, the District of Columbia, five large urban areas, and territories and protectorates to provide immunization services to priority populations.[12]

Predict an individual's health and wellness and/or that of their offspring

Vaccination is one of the best ways parents can protect infants, children, and teens from 16 potentially harmful and contagious diseases. Vaccine-preventable diseases can be very serious, may require hospitalization, cause long-lasting health complications, or even be deadly – especially in infants and young children.[13]

In addition to protecting an individual child's health, specific immunizations also can protect future generations. For example, once a female infant or child has been fully immunized against Hepatitis B, she also is protecting any future children she may have from the possibility of perinatal transmission. In some cases, specifically children of refugees from countries where Hepatitis B is endemic, the Hepatitis B vaccine provides the opportunity to break the cycle of maternal to child transmission which may not be present in the country of origin.

While this particular indicator pertains to childhood immunizations, it should be noted that immunizations are recommended throughout a person's life. The CDC sets recommended adolescent and adult immunization schedules along with the infant and childhood schedules. Adolescents need to be immunized because vaccine protection from some childhood vaccines wears off over time and boosters are needed, and also because some vaccines, like HPV, are given

only during the preteen years.[14] Adults need booster vaccinations for some childhood vaccines, but also may need vaccines against diseases such as influenza and pneumococcal pneumonia.[15]

Data Criteria

Data availability

The NIS is a list-assisted random-digit-dial telephone survey followed by a mailed survey to children's immunization providers. Parent/guardian respondents provide vaccination and sociodemographic information on children or adolescents in their care. The NIS began data collection in April 1994 to monitor childhood immunization coverage. The survey is conducted jointly by the National Center for Immunizations and Respiratory Diseases and the National Center for Health Statistics, CDC.

The study collects data by interviewing households in all 50 States, the District of Columbia and selected large urban areas. The target population for the NIS is children between the ages of 19 and 35 months living in the United States at the time of the interview. Vaccinations included in the survey are: diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP); poliovirus vaccine (polio); measles-containing vaccine (MCV); Haemophilus influenzae type b vaccine (Hib); hepatitis B vaccine (Hep B); varicella zoster vaccine (chicken pox), pneumococcal conjugate vaccine (PCV), hepatitis A vaccine (Hep A), and influenza vaccine (FLU). Survey data are used to calculate vaccine coverage rates based on the recommended number of doses to be up to date, as recommended by the Advisory Committee on Immunization Practices (ACIP). Estimates are produced for the nation and non-overlapping geographic areas consisting of the 50 states, the District of Columbia, and selected large urban areas. Data files for the NIS are available starting with 1995.

State-level data on immunization coverage from NIS for the series included in this indicator are published annually through the CDC Morbidity and Mortality Weekly Report (in September for the previous year's data). State level data from 2011 is currently available on the CDC website (users can download the dataset and SAS and R input statements from the CDC website at cdc.gov/nchs/nis/data_files.htm). Data users should note that the 2011 data includes a modified series where Hib was not analyzed, due to a shortage of vaccines.

Data quality

For both the NIS and the NIS-Teen, parents and guardians are asked for consent for a second phase of the study in which the child or adolescent's pediatrician is contacted. The provider receives an immunization history questionnaire to fill out for the selected child; this information is used to ensure the accuracy and precision of the immunization coverage estimates. CDC publishes a NIS "Guide to Quality Control Procedures" that describes the procedures used to ensure the quality of the data through all phases of the sampling, data collection, and processing.

The data are weighted to reduce potential biases from non-response and non-coverage. In addition to households with an eligible child that do not respond to the survey, an additional source of potential error is a household that responds but does not have complete provider information. Item non-response for the NIS is typically very low. However, for data elements used in weighting, the hot-deck method of imputation is used. Although in one year a total of about 14,000 data elements are imputed, these account for only 0.08 percent of all data items in the file.

The findings in the NIS are subject to at least four limitations. First, 2011 was the first year that the NIS used a dual-frame sampling scheme that included landline and cell phones for households, thus estimates might not be comparable with those from previous years when surveys were conducted using landline phones only. Although differences between national landline and dual-frame estimates for specific vaccines in the 2011 NIS were small, (absolute magnitude <1 percent), larger variations were observed for state-specific coverage estimates. Comparisons of 2011 estimates with those of previous years at the state level should be interpreted with caution. Second, immunization coverage might have been underestimated because of the exclusive use of provider-reported vaccination records. Completeness of these records is unknown, and estimates might have been biased upwards or downwards if immunization coverage among children without provider records differed from immunization coverage among children with provider data. Third, although survey results are weighted, bias could still remain because of non-response and exclusion of households without telephone service. Finally, although national immunization coverage estimates are precise, confidence intervals are much wider for state estimates, thus the point estimates should be interpreted with caution.[1]

Simplicity of indicator

This indicator is complex for several reasons. Immunization coverage rates are available for individual vaccinations and also several different vaccination series. These immunization coverage rates also are available for all the modifiers listed above. Determining an accurate cross walk for vaccine alone versus vaccine series and against multiple modifiers could be difficult due to comparability issues. Further, while the point estimates of an area's immunization coverage rate are available and useful for certain advocacy activities, care must be taken to include a discussion of the 95 percent confidence intervals around the immunization coverage estimates and to compare this data over time.[2]

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