Using Surveillance Indicators for Vaccine-Preventable Diseases (VPDs): National Notifiable Diseases Surveillance System (NNDSS)

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Purpose:
The purpose of surveillance indicators is to assess performance of essential components of surveillance
and case investigation, and to identify components of each that need improvement. This report
provides data that can be used to assess national surveillance and data quality for measles, mumps,
rubella, Haemophilus influenzae, pertussis, invasive pneumococcal disease (IPD), meningococcal
disease, and varicella in terms of surveillance infrastructure, timeliness of reporting, adequacy of case
investigation, and appropriateness of laboratory testing and diagnostic effort.

Background:
Surveillance indicators for vaccine-preventable disease (VPD) surveillance were originally developed
by the Pan American Health Organization (PAHO) in 1988, in the context of surveillance for polio and
acute flaccid paralysis. The national surveillance system in the U.S., the Notifiable Diseases
Surveillance System (NNDSS), is a passive system designed to monitor epidemiologic trends and to
assess programmatic impact. Cases are reported by the states to CDC electronically through the
National Electronic Telecommunications System for Surveillance (NETSS) or the National Electronic
Disease Surveillance System (NEDSS).

Many factors contribute to variations in reporting for VPDs, including disease/condition characteristics
(e.g., symptoms, incidence, severity), availability of laboratory diagnostics, patient and provider
awareness, jurisdiction attributes (e.g., laws/regulations), disease transmission setting, and capacity for
electronic data transmission.

Methods/Analyses:
The final surveillance data from NNDSS for 2007-2015 and provisional for 2016 were analyzed to
assess surveillance indicators for measles (confirmed and unknown case status); mumps (confirmed,
probable, and unknown case status); rubella (confirmed and unknown case status); Haemophilus
influenzae (confirmed, probable, and unknown case status); pertussis (confirmed, probable, and
unknown case status); invasive pneumococcal disease (confirmed case status); meningococcal disease
(confirmed and probable case status); and varicella (confirmed and probable case status). For measles,
mumps, rubella, H. influenzae, invasive pneumococcal disease, meningococcal disease, and pertussis,
missing values were considered invalid and unknown values were considered valid. For varicella both
missing and unknown values were considered invalid.

Measles, mumps, and rubella have four indicators in common:
▪ The proportion of cases with complete information (clinical case definition, hospitalization, lab
testing, vaccine history, date reported to health department, transmission setting, outbreak
related, epidemiologic linkage, date of birth, and onset date)
▪ The interval between date of symptom onset and date of public health notification
▪ The proportion of confirmed cases that are laboratory confirmed
▪ The proportion of cases that have an imported source

Measles-specific indicators include:
◊ The proportion of cases for which at least one clinical specimen for viral isolation was
  submitted to CDC or to the four reference Centers of Excellence
◊ The number of discarded measles-like illness (MLI) reports (discontinued January 2006)
Rubella-specific indicator is:
◊ The proportion of confirmed cases among women of child-bearing age with known pregnancy status

*Haemophilus influenzae* surveillance indicators include:
- The proportion of cases with complete information (clinical case definition – species, specimen type; vaccine history; and serotype testing)
- The proportion of cases among children <5 years of age with complete vaccine history (with/without manufacturer name)
- The proportion of cases among children <5 years of age with serotyping testing

Pertussis surveillance indicators include:
- The proportion of cases with complete information (clinical case definition, complications, antibiotic treatment, laboratory testing, vaccine history, and epidemiologic data – outbreak/epidemiologic linkage)
- The interval between date of symptom onset and date of public health notification
- The proportion of confirmed cases that are laboratory confirmed
- The proportion of cases with complete vaccine history (with/without manufacturer name)

*Invasive pneumococcal disease (IPD)* surveillance indicators include:
- The proportion of confirmed cases (event code 11723) with complete information (clinical case definition, species/specimen type, vaccine history, and serotype testing)
- The proportion of confirmed cases with serotype testing
- The proportion of confirmed cases with complete vaccine history (with/without manufacturer name)

Meningococcal disease surveillance indicators include:
- The proportion of cases with complete information (birth date or age and event date)
- The number of confirmed cases
- The proportion of cases with known outcome
- The proportion of confirmed cases with serogroup testing
- The proportion of cases with complete vaccine history (with/without manufacturer name)

*Varicella* surveillance indicators include:
- The proportion of cases with complete information on age
- The proportion of cases with complete information on number of lesions
- The proportion of cases with complete information on hospitalization
- The proportion of confirmed cases
- The proportion of cases with lab testing
- The proportion of cases related to outbreaks
- The proportion of cases with complete vaccine history (without manufacturer name)

**Results:**
See attached tables 1-6 for national surveillance indicator summaries for 2007-2016. See also jurisdiction-specific summaries.
Conclusions:

- Surveillance indicators can assess the quality of the national electronic surveillance data. Although these indicators may not accurately reflect jurisdiction-based data or surveillance effort in certain situations, the indicators can identify components of surveillance and electronic data exchange that need improvement at the local, state, and federal levels.
- For measles cases, effort must be maintained to ensure data completeness, determination of importation status, and laboratory testing at CDC or at the four reference Centers of Excellence.
- For mumps cases, effort must be enhanced to achieve data completeness.
- For rubella cases, effort must be enhanced to achieve data completeness, focusing on pregnancy status for females and importation status for all cases.
- For H. influenzae cases, effort must be enhanced to achieve data completeness, especially for serotype testing and vaccine history for cases <5 years.
- For pertussis cases, effort must be enhanced to document adult and child vaccine history, while also building laboratory testing infrastructure.
- For IPD cases, effort must be enhanced to achieve transmission of key variables to CDC in order to improve data completeness.
- For meningococcal disease cases, effort must be enhanced to document adult and child vaccine history, while also ensuring serogroup testing.
- For varicella cases, effort must be enhanced to achieve data completeness.

Recommendations:

- Continue annual assessment of VPD surveillance indicators.
  ◊ Continue accountability for data system challenges.
  ◊ Monitor progress in surveillance effort.
  ◊ Pending resolution, note that data from NBS states do not accurately represent state data or surveillance effort.
- Communicate assessment results to partners and support follow up.
- Apply results in setting surveillance goals and strategies.
- Implement message mapping guides and use harmonized standards and specifications for data collection and electronic data transmission.
- Resolve electronic issues for NBS states’ data in the national surveillance data set.

Limitations of Analyses:

- Phased implementation of data systems (NETSS mid-1990’s, NEDSS/NBS ongoing).
- Published data (MMWR) are possibly different from data set prior to mid-1990’s.
- Incomplete data may be due to data system (transmission errors, coding errors) in addition to investigative effort.
- Few external standards are available to monitor case reporting completeness.