Streptococcus pneumoniae, Invasive Disease
Investigation Guideline

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Fact Sheet  

Attachments can be accessed through the Adobe Reader’s navigation panel for attachments. Throughout this document attachment links are indicated by this symbol; when the link is activated in Adobe Reader it will open the attachments navigation panel. The link may not work when using PDF readers other than Standard Adobe Reader.
## Revision History:

<table>
<thead>
<tr>
<th>Date</th>
<th>Replaced</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>05/2018</td>
<td>12/2014</td>
<td>Updated Invasive Pneumococcal Disease case definition. Notification Section modified with requirements of revised regulations.</td>
</tr>
<tr>
<td>12/2014</td>
<td>11/2010</td>
<td>Reformatted Standard Case Investigation and Data Management section to assist with EpiTrax system data entry. Added a Notification section. Updated web links, including link to the most current CDC recommendation for the use of pneumococcal vaccine. Reformatted fact sheet.</td>
</tr>
<tr>
<td>11/2010</td>
<td>01/2010</td>
<td>Removal of clinically compatible from the listed case definition to bring it into agreement with CDC guidance. (In 02/2012, removed references to KS-EDSS.)</td>
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</table>
CASE DEFINITION (CDC 2017) – Invasive Pneumococcal Disease (IPD) 
(Streptococcus pneumoniae)

Clinical Description for Public Health Surveillance:
Invasive Pneumococcal (Streptococcus pneumoniae) Disease or IPD causes many clinical syndromes, depending on the site of infection (e.g., bacteremia, meningitis.)

Laboratory Criteria for Case Classification:
Supportive: Identification of S. pneumoniae from a normally sterile body site by a CIDT without isolation of the bacteria.
Confirmatory: Isolation of S. pneumoniae from a normally sterile body site.

Criteria to Distinguish a New Case from Existing Case: A single case should be defined as a health event with a specimen collection date that occurs more than 30 days from the last known specimen with a positive lab finding.

Case Classification:
• Probable: A case that meets the supportive laboratory evidence.
• Confirmed: A case that meets the confirmatory laboratory evidence.

Comments: The use of CIDTs as stand-alone tests for the direct detection of S. pneumoniae from clinical specimens is increasing. Data regarding their performance indicate variability in the sensitivity, specificity, and positive predictive value of these assays depending on the manufacturer and validations methods used. It is therefore useful to collect information on the laboratory conducting the testing, and the type and manufacturer of the CIDT used to diagnose each IPD case. Culture confirmation of CIDT-positive specimens is still the ideal method of confirming a case of IPD.

CASE DEFINITION (CDC 2007) – Streptococcus pneumoniae, Drug-Resistant Invasive Disease (DRSP) [Used for all ages.]

Clinical Description for Public Health Surveillance
Same as above for invasive Streptococcus pneumoniae.

Laboratory Criteria for Case Classification:
• Isolation of S. pneumoniae from a normally sterile site (e.g., blood, cerebrospinal fluid, or, less commonly, joint, pleural, or pericardial fluid) and
• "Nonsusceptible" isolate (i.e., intermediate- or high-level resistance* of the S. pneumoniae isolate to at least one antimicrobial agent currently approved for use in treating pneumococcal infection.)

* Resistance defined by National Committee for Clinical Laboratory Standards (NCCLS)-approved methods and NCCLS-approved interpretive minimum inhibitory concentration (MIC) standards (μg/ml) for S. pneumoniae.

Case Classification:
• Confirmed: Case that is laboratory-confirmed.
• Probable: Case caused by laboratory-confirmed culture of S. pneumoniae identified as "nonsusceptible" (i.e., an oxacillin zone size of less than 20 mm) when oxacillin screening is the only method of antimicrobial susceptibility testing performed.
LABORATORY ANALYSIS

- Gram stains and cultures are performed routinely by commercial laboratories.
- Submission of invasive *S. pneumoniae* isolates to the Kansas Health and Environmental Laboratory (KHEL) *is required by law.* (K.A.R. 28-1-18)
- Shipping of isolates: Use Miscellaneous Infectious Disease (IDS) Shipper.
- For additional information and/or questions concerning isolate submission call (785) 296-1620.

EPIDEMIOLOGY

*S. pneumoniae* is a leading cause worldwide of illness and death for young children, persons with underlying medical conditions, and the elderly. It is the most commonly identified cause of bacterial pneumonia; and, since the widespread use of vaccines against *Haemophilus influenzae* type b, it has become the most common cause of bacterial meningitis in the United States. Rates of invasive disease are highest among persons younger than 2 years of age and those 65 years of age or older. Pneumococci are in the upper respiratory tract of 15% of well adults; in child care settings, up to 65% of children are colonized. Although pneumococcal carriage can lead to invasive disease, acute otitis media (AOM) is the most common clinical manifestation among children and the most common outpatient diagnosis resulting in antibiotic prescriptions in that group. Approximately 12% of all patients with invasive pneumococcal disease die of their illness, but case-fatality rates are higher for the elderly and patients with certain underlying illnesses.

Before 1990, *S. pneumoniae* was almost uniformly susceptible to penicillin, allowing most physicians to treat persons with severe infections with penicillin alone. However, during the 1990s, resistance to penicillin and to multiple classes of antimicrobial agents spread rapidly in the United States, with an increasing trend of invasive pneumococci resistant to three or more drug classes. In 1998, 24% of invasive pneumococcal isolates were non-susceptible to penicillin, and 78% of these strains belonged to five of the seven serotypes included in PCV7, a 7-valent pneumococcal polysaccharide–protein conjugate vaccine. Following the introduction of PCV7 into the routine childhood immunization program in 2000, the incidence of antibiotic-resistant invasive disease declined substantially. In 2004, the rate of penicillin- non-susceptible invasive disease caused by serotypes included in PCV7 had declined by 98% among children younger than 2 years of age and by 79% among adults 65 years or older. In contrast, there was an increase in penicillin-resistant disease caused by serotypes not included in PCV7, but the magnitude of this effect remains small.
DISEASE OVERVIEW

A. **Agent:**
   *S. pneumoniae*, Gram positive diplococcus. Nearly all strains causing invasive disease are encapsulated; there are 90 known capsular serotypes.

B. **Clinical Description:**
   Several invasive clinical syndromes, including pneumonia, bacteremia and meningitis. *S. pneumoniae* is also a cause of AOM and mastoiditis.

   **Reservoirs:**
   Humans.

C. **Mode(s) of Transmission:**
   *S. pneumoniae* are transmitted person-to-person by large droplet spread and/or by contact with respiratory secretions. Casual contact can result in nasopharyngeal carriage of the organism without illness developing. Individuals with acute respiratory tract infections (particularly nasal) can transmit noninvasive infection (i.e. upper respiratory infections). Invasive disease is not transmitted person-to-person as it only occurs after the bacteria get past the immune defenses of a person who is infected or colonized.

D. **Incubation Period:**
   Unknown, probably short, 1-4 days.

E. **Period of Communicability:**
   As long as organism is present in respiratory secretions; a person is regarded as noninfectious 24-48 hours after appropriate antibiotic treatment begins.

F. **Susceptibility and Resistance:**
   Immunity associated with circulating bactericidal and/or anticapsular antibody, acquired transplacentally or from prior infection or immunization.

G. **Treatment:**
   Penicillin, ceftriaxone, or cefotaxime are drugs of choice. When resistance is widespread, treatment will usually include a broad-spectrum cephalosporin, and often vancomycin, until results of antibiotic sensitivity testing are available.
NOTIFICATION TO PUBLIC HEALTH AUTHORITIES

Suspected cases of invasive *Strep. pneumoniae* shall be reported within 24 hours, except if the reporting period ends on a weekend or state-approved holiday, the report shall be made by 5:00 p.m. on the next business day after the 24-hour period.

1. Health care providers and hospitals: report to local health jurisdiction
2. Laboratories: report to KDHE - BEPHI
3. Local health jurisdiction: report to KDHE - BEPHI

**Kansas Department of Health and Environment (KDHE)**
**Bureau of Epidemiology and Public Health Response (BEPHI)**

Phone: 1-877-427-7317
Fax: 1-877-427-7318

Further responsibilities of state and local health departments to the CDC:
As a nationally notifiable condition, *Streptococcus pneumoniae*, invasive disease (IPD) cases require a ROUTINELY NOTIFIABLE report to the Center of Disease Control and Prevention (CDC).

1. Routine reporting requires KDHE-BEPHI to file an electronic report for within the next reporting cycle.
   - KDHE-BEPHI will file electronic reports weekly with CDC.
2. Local public health jurisdiction will report information requested in the Kansas electronic surveillance system, as soon as possible, ensuring that the electronic form is completed within 7 days of receiving a notification of a report.

INVESTIGATOR RESPONSIBILITIES

1) **Report** all confirmed, probable and suspect cases to the KDHE.
2) Begin the public health investigation within 3 days of receiving a report; completing the investigation within 7 days.
3) The goal of the case investigation is to collect epidemiological data as required by current surveillance objectives.
   - Contact the medical provider to collect additional information and confirm diagnosis using the current case definition.
   - Collect all information requested in Step 1) of case investigation.
   - Most data can be collected from the medical provider, and the patient will not need to be contacted.
   - Routine contact investigation and/or an investigation for a source is of no practical value for *S. pneumoniae* cases.
4) Ensure invasive *S. pneumoniae isolates* were sent to the state laboratory.
5) **Record** data, collected during the investigation, in the KS EpiTrax system under the data’s associated [tab] in the case morbidity report (CMR).
6) As appropriate, use the disease fact sheet to notify individuals or groups.
STANDARD CASE INVESTIGATION AND CONTROL METHODS

Case Investigation
1) Contact the medical provider who reported or ordered testing of the case to obtain the following from the patient’s medical records.

   For all cases, the following data is ESSENTIAL:
   - Demographic data (birth date, county, sex, race/ethnicity) [Demographic]
   - Anatomic site from which organism is isolated [Laboratory]
   - Type of infection [Investigation-Symptoms]
   - Antibiotic susceptibility – scanned and attach to CMR [Notes-Add Attachment]

   Additional information to collect for cases includes:
   - Onset date of illness [Clinical];
   - Attendance at a daycare facility: include name of facility [Epidemiological];
   - Hospitalizations: location and duration of stay [Clinical];
   - Outcomes: survived and date of recovery or date of death [Clinical];
   - Underlying medical conditions prior to illness [Investigation-Complications];
   - Date first positive culture obtained [Laboratory]; and
   - Through a credible immunization registry or medical record information on pneumococcal vaccination(s), including date(s) of vaccination, vaccine name, manufacturer, lot number [Investigation-Vaccination History]

2) If there is no indication that the isolate has been sent to KHEL, call or send a reminder to the laboratory that performed the testing that they are required by law to submit all invasive S. pneumoniae isolates to the state laboratory.

3) Investigate any epi-links among cases (cluster, household, co-workers, etc) if identified. For suspected outbreaks refer to Managing Special Situations.

Contact Investigation
Contact investigation is of no practical value for routine situations.

Isolation, Work and Daycare Restrictions
Hospitalized patients: Standard precautions are recommended, including patients with infections caused by drug-resistant S. pneumoniae.

Case Management
Report on any changes in patient status (i.e. date of death). [Clinical]

Contact Management
None required.

Environmental Measures
In day care settings, the regularly cleaning of toys with an approved disinfectant is recommended. For more information on S. pneumoniae in daycares, refer to Managing Special Situations.
Education
If contacts or household members inquire about their risk of acquiring the disease:

- Use the *S. pneumoniae* fact sheet to answer inquiries.
- Stress the following:
  - Invasive disease is not spread person-to-person;
  - Antibiotic treatment is not an effective way of protecting contacts exposed to a meningitis caused by bacteria, other than *N. meningitidis* or *H. influenzae* type B; but
  - Medical attention should be sought immediately if they do begin to exhibit signs and symptoms of severe illness.

- Instruct household members or close contacts to:
  - Practice basic hygiene emphasizing proper hand washing technique.
  - Avoid sharing food, beverages, cigarettes or eating utensils.

- Those at high risk or presumed high risk of acquiring invasive pneumococcal infection (i.e., immunocompromised, sickle cell disease, or functional or anatomic asplenia) should be directed to discuss current health status (including immunization history) with their primary care physician and/or routine immunization provider.
  - The local health department should strive to make sure those in the groups recommended for immunization have access the vaccine.
  - Current recommendations for pneumococcal vaccine usage can be found at [www.cdc.gov/vaccines/vpd-vac/pneumo/default.htm](http://www.cdc.gov/vaccines/vpd-vac/pneumo/default.htm)

MANAGING SPECIAL SITUATIONS

A. Outbreak Investigation:

1. Consider further investigation of any invasive cases clustered in time and place among groups that share common space (i.e. daycare, institutions)
3. Case finding and additional case investigation will be an important part of any investigation.

B. Daycares and *Streptococcus pneumoniae*

- Out-of-home day care increases the risk for invasive pneumococcal disease and AOM among children. Day care attendance is also a risk factor for other acute upper respiratory tract infections among children aged <5 years. (Source: [www.cdc.gov/mmwr/preview/mmwrhtml/rr4909a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/rr4909a1.htm))

- Children aged 24--59 months who attend group daycares (defined by any setting outside a home where a child regularly spends >4 hours/week with >2 unrelated children under adult supervision) were considered part of a priority group that the ACIP recommends receive PCV7 vaccination.

- Reference K.A.R. 28-1-20 for current immunization requirements for daycares; on-line at: [www.kdheks.gov/immunize/schoolInfo.htm](http://www.kdheks.gov/immunize/schoolInfo.htm)
DATA MANAGEMENT AND REPORTING TO THE KDHE

A. Accept the case assigned to the LHD and record the date the LHD investigation was started on the [Administrative] tab.

B. Organize and collect data.
   - The *Streptococcus pneumoniae Surveillance Worksheet* is provided to assist the investigator but does not have to be submitted to CDC or KDHE.
   - Investigators can collect and enter all required information directly into EpiTrax [Investigation], [Clinical], [Demographics], and [Epidemiological] tabs without using the paper forms.
   - During outbreak investigations, refer to guidance from a KDHE epidemiologist for appropriate collection tools.

C. Report data collected during the investigation via EpiTrax.
   - Verify that all data requested in Step 1 has been recorded on an appropriate EpiTrax [tab], or that actions are completed for a case lost to follow-up as outlined below.
   - Some data that cannot be reported on an EpiTrax [tab] may need to be recorded in [Notes] or scanned and attached to the record.
   - Paper report forms do not need to be sent to KDHE after the information is recorded in EpiTrax. The forms should be handled as directed by local administrative practices.

D. If a case is lost to follow-up, after the appropriate attempts:
   - Indicate ‘lost to follow-up’ on the [Administration] tab with the number of attempts to contact the case recorded.
   - Record at least the information that was collected from the medical records.
   - Record a reason for ‘lost to follow-up’ in [Notes].

E. After the requirements listed under Case Investigation have been completed, record the “Date LHD investigation completed” field located on the [Administrative] tab.
   - Record the date even if the local investigator’s Case or Contact Management for the contact is not “Complete”.

F. Once the entire investigation is completed, the LHD investigator will click the “Complete” button on the [Administrative] tab. This will trigger an alert to the LHD Administrator so they can review the case before sending to the state.
   - The LHD Administrator will then “Approve” or “Reject” the CMR.
   - Once a case is “Approved” by the LHD Administrator, BEPHI staff will review the case to ensure completion before closing the case.


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**Reporting to CDC for Children, < 5 years**

Since 2007, a case definition and a separate event code is available for reporting of pneumococcal disease (non-drug resistant) for children <5 years.

- Isolates causing IPD from children less than five years of age for which antibacterial susceptibilities are available and determined to be DRSP should be reported only as DRSP (event code 11720).
- Isolates causing *IPD* from children less than five years of age which are susceptible, or for which susceptibilities are not available should be reported ONLY as *IPD* in children less than five years of age (event code 11717).
ADDITIONAL INFORMATION / REFERENCES


C. Case Definitions: www.cdc.gov/nndss/

D. Kansas Regulations/Statutes Related to Infectious Disease: www.kdheks.gov/epi/regulations.htm

E. Pink Book: Epidemiology and Prevention of Vaccine-Preventable Diseases. Available at: www.cdc.gov/vaccines/pubs/pinkbook/index.html


G. Preventing Pneumococcal Disease Among Infants and Young Children; Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR December 9, 2005 / 54(RR14); 1-16. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/rr4909a1.htm


ATTACHMENTS

To view attachments in the electronic version:
1. Go to <View>; <Navigation Pane>; <Attachments> – OR – Click on the “Paper Clip” icon at the left.
2. Double click on the document to open.
**Streptococcus pneumoniae Surveillance Worksheet**

(Invasive pneumococcal disease and drug-resistant *S. pneumoniae*)

**Name** (Last, First) Hospital Record No.  
Address (Street and No.) City County Zip Phone

**Reporting Physician/Nurse/Hospital/Clinic/Lab** Phone Address Phone

**Detach here and transmit only lower portion if sent to CDC**

1. Are you reporting:  
   Drug Resistant *S. pneumoniae*  
   Invasive Disease

2. Date of Birth  
   MONTH DAY YEAR

3a. Age

3b. Is age in years / months / weeks / days?  
   [ ] years  [ ] months  [ ] weeks  [ ] days

4. Sex  
   [ ] Male  [ ] Female  [ ] Unknown

5. Race: (check all that apply)  
   [ ] American Indian / Alaska native  
   [ ] Asian  
   [ ] Black or African American  
   [ ] Native Hawaiian or Pacific Islander  
   [ ] White  
   [ ] Other race (specify) ____________

6. Ethnicity: is patient Hispanic or Latino?  
   [ ] Yes  [ ] No  [ ] Unknown

7. State in which patient resided at time of diagnosis:

8. Zip code at which patient resided at time of diagnosis: ____________

9a. Hospitalized?  
   [ ] Yes  [ ] No  [ ] Unknown

9b. If hospitalized for this condition, how many days total was the patient hospitalized? (Include days from multiple hospitals if relevant)  
   NUMBER OF DAYS: 0-998; 999=UNKNOWN

10. Does this patient: (check all that apply)  
    Attend a day care* facility?  
    [ ] Yes  [ ] No  [ ] Unknown  
    *DAY CARE IS DEFINED AS A SUPERVISED GROUP OF 2 OR MORE UNRELATED CHILDREN FOR >4 HOURS PER WEEK.
    
    Reside in a long term care facility?  
    [ ] Yes  [ ] No  [ ] Unknown

11. Did patient die from this illness?  
    [ ] Yes  [ ] No  [ ] Unknown

12. Onset Date  
    MONTH - DAY - YEAR

13. Type of infection caused by organism (check all that apply)  
    Bacteremia without focus  
    Cellulitis  
    Epiglottitis  
    Hemolytic uremic syndrome  
    Meningitis  
    Osteomyelitis  
    Otitis media  
    Peritonitis  
    Pericarditis  
    Pneumonia  
    Septic arthritis  
    Other (specify) ____________

14. Sterile site from which organism isolated:    (check all that apply)  
    Blood  [ ] Joint  
    CSF  [ ] Bone  
    Pleural fluid  [ ] Internal body site  
    Peritoneal fluid  [ ] Muscle  
    Pericardial fluid  [ ] Other normally sterile site ____________

15. Date first positive culture obtained  
    DATE SPECIMEN TAKEN  
    MONTH - DAY - YEAR

16. Nonsterile sites from which organism isolated, if any:  
    Middle ear  [ ] Sinus  [ ] Other (specify) ____________

17a. Does the patient have any underlying medical conditions or prior illness?  
    [ ] Yes. If yes fill out 17b.  
    [ ] No. If no skip to 18.  
    [ ] Unknown. Skip to 18.

17b. What underlying medical conditions does the patient have? (check all that apply)  
    [ ] Current smoker  
    [ ] Multiple myeloma  
    [ ] Sickle cell anemia  
    [ ] Splenectomy / asplenia  
    [ ] Immunoglobulin deficiency  
    [ ] Immunosuppressive therapy (steroids, chemotherapy, radiation)  
    [ ] Leukemia  
    [ ] Hodgkin's disease  
    [ ] Asthma  
    [ ] Emphysema / COPD  
    [ ] Systemic lupus erythematosus  
    [ ] Diabetes mellitus  
    [ ] Nephrotic syndrome  
    [ ] Renal failure / dialysis  
    [ ] HIV infection
AIDS (CD4 <200)
Cirrhosis / liver failure
Alcohol abuse
Cardiovascular disease (ASCVD) / CAD
Heart failure / CHF
CSF leak
Intravenous drug use
Other malignancy (specify)
Organ / bone marrow transplant
Other prior illness (specify)

Vaccination History

18. Did patient receive POLYSACCHARIDE pneumococcal vaccine? Y  N  U  If YES, please complete the list below.

<table>
<thead>
<tr>
<th>DOSE</th>
<th>DATE GIVEN (MONTH/DAY/YEAR)</th>
<th>VACCINE NAME</th>
<th>MANUFACTURER</th>
<th>LOT NUMBER</th>
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<tr>
<td>1</td>
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<td>Pneumovax 23 (Merck)</td>
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<td>2</td>
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<td>Pneumovax 23 (Merck)</td>
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<tr>
<td>3</td>
<td></td>
<td>Pneumovax 23 (Merck)</td>
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</table>

19. Did patient receive CONJUGATE pneumococcal vaccine? Y  N  U  If YES, please complete the list below.

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<tr>
<th>DOSE</th>
<th>DATE GIVEN (MONTH/DAY/YEAR)</th>
<th>VACCINE NAME</th>
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20. Resistance Testing Results

Oxacillin zone size: [ ] mm  Oxacillin interpretation: R < 20mm (possibly resistant)  S ≥20mm (susceptible)  Unknown/not tested

<table>
<thead>
<tr>
<th>SUSCEPTIBILITY METHOD CODES</th>
<th>S/I/R RESULT CODES</th>
<th>SIGN CODES</th>
<th>MIC VALUE</th>
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<tbody>
<tr>
<td>A- AGAR: Agar dilution method B- BROTH: Broth dilution C- DISK: Disk diffusion (Kirby Bauer) S- STRIP: Antimicrobial gradient strip (E-test)</td>
<td>S- SUSCEPTIBLE B- INTERMEDIATE C- RESISTANT S- UNK. / NOT TESTED</td>
<td>Indicate whether the MIC is &lt;, &gt;, ≤, ≥, = to the numerical MIC value in the last column</td>
<td>Valid range for data value 0.000 - 999.999</td>
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| MIC = minimum inhibitory concentration |

21. Antimicrobial Agent

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<th>ANTIBIOTIC</th>
<th>SUSCEPTIBILITY METHOD A/B/D/S</th>
<th>S/I/R/U RESULT</th>
<th>SIGN &lt;</th>
<th>&gt;</th>
<th>≤</th>
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<th>=</th>
<th>MIC VALUE (e.g., 0.06 µg/ml)</th>
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<td>Moxifloxacin</td>
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Submitted by: ___________________________  Phone (______)  Date: ______________________

MONTH  DAY  YEAR