

GUIDELINES FOR IMPLEMENTING AND REPORTING EPIDEMIOLOGIC INVESTIGATIONS (EPI-AIDS)

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BACKGROUND

In establishing the Communicable Disease Center (CDC) in July 1946, the USPHS Surgeon General directed that the organization help states control communicable diseases by providing technical assistance and training. In October 1947, CDC was assigned responsibility for epidemic aid to states. In 1951, Dr. Alexander Langmuir began the Epidemic Intelligence Service (EIS) to develop a cadre of field-trained epidemiologists able to meet national needs. In the years since, the EIS has gained national and worldwide recognition for effective public health service and training.

Consistent with CDC's (still CDC, but now Centers for Disease Control) charter, the EIS has always placed highest priority on providing a prompt and appropriate response to a request for epidemiologic assistance. As of January 1990, over 3,000 requests for epidemiologic assistance (termed through the years "Epi-Aids" or "Epi-Aid Missions") have been conducted by EIS Officers and other CDC staff.

A request for assistance may be initiated by a private or public institution or a private individual. The health problem must be brought to the attention of the state epidemiologist, who should notify CDC and request an Epi-Aid after determining that epidemiologic assistance is needed. The initial contact is generally made to the CDC Center/Institute/Office (CIO) with primary responsibility for the health problem. The CIO should discuss the request for epidemiologic assistance with the Epidemiology Program Office to determine the level of support that the Epi-Aid funds can provide.

In the performance of an Epi-Aid mission, the EIS Officer is required to complete two reporting documents, the EPI-1 Report and the EPI-2 Report. The Epi-Aid reports are considered to be valuable communication and educational tools for the EIS Officers and interested, high-level public health officials. The reports provide documentation needed by state and local officials of the assistance provided, studies performed (methodology and results), findings, and recommendations made by the CDC investigators. The EPI-1 Report is addressed to the CDC Director, informs appropriate individuals of the suspected health problem, and is written by the investigating officer before s/he leaves on the Epi-Aid mission. The EPI-2 Report is a scientific report providing the early final results or findings of the investigation and is published within 14 calendar days after the Officer returns to the duty station.

This guide is provided to assist CDC personnel in preparing the required epidemiologic investigation reports and in notifying appropriate individuals about the request for assistance.

EPIDEMIOLOGIC ASSISTANCE POLICIES AND GUIDELINES

Definition of Epidemiologic Assistance (Epi-Aid)

The Epi-Aid mechanism is an administrative procedure managed by EPO in order to provide financial support for epidemiologic field investigations by EIS Officers and other CDC professional staff. In addition to financial support, the Epi-Aid mechanism provides that OMB prior approval of specific investigations is not required provided that data collection does not exceed 30 days. Specific questions regarding the need for clearance by an Institutional Review Board (IRB) for investigations involving human subjects should be addressed by the IRB contact persons within the CIOs. In general, IRB review is not necessary for an Epi-Aid if the study is done a) to determine the cause and/or extent of a particular, current health problem and b) to develop plans for its control.

The Epi-Aid mechanism is invoked when the conditions detailed below exist:

- Epidemiologic assistance has been requested by appropriate officers of a state, international health agency, or foreign government;
- The request involves a problem of public health importance;
- Timely response is required;
- Epidemiologic methods are primarily required;
- The investigations should contribute to the professional development of EIS Officers in practical epidemiology;
- Other sources of support are not available; and
- This mechanism is not intended to be a substitute for planned or ongoing activities.

Implementation Guidelines for an Epi-Aid:

- State-based EIS Officers (EISOs) are CDC's first line of epidemiologic assistance in a given state. They should be notified of impending investigations in their states and, when possible, offered the opportunity to participate.
- The number of persons supported by an Epi-Aid should be appropriate to the size and nature of the investigation. Except under unusual circumstances, no more than three persons should be supported under this mechanism, including trainees.

- The program directing an investigation is responsible for writing the EPI-1 Report. Responsibility for writing the EPI-2 should be assigned at the time the EPI-1 is prepared.
- The duration of support should be verbally agreed upon by EPO and the relevant CDC program when the Epi-Aid investigation is initiated. If needed, extensions should be negotiated by EPO and the program in the course of the investigation.
- Responsibility for supervising CDC staff involved in an Epi-Aid is to be assumed by the program with expertise in the subject area. The name of the supervisor will be stated on the EPI-1.
- Requests for support of international investigations should come to EPO only after discussion with the International Health Program Office (IHPO) which will explore other possible sources of support for the Epi-Aid. If appropriate, the relevant CDC program and IHPO will then request EPO's assistance through the Epi-Aid mechanism and will cosign the international EPI-1 Report.
- Travel conducted in the course of the Epi-Aid unrelated to the investigation will be paid for by the CDC program.
- The "5-day letter" and "EPI-2" have been replaced by a single report, the EPI-2. The EPI-2 is a written summary of the investigation which must be completed within 14 calendar days after the investigators return to their duty station and provided to the requesting organization. The responsible CDC program may close the file on the investigation at this time or, if appropriate, a subsequent EPI-3 may be prepared. EPO will track the various investigative reports to ensure responsiveness to these guidelines.
- In general, a single trip should be sufficient to complete an Epi-Aid. One follow-up trip can be supported by this mechanism, if considered necessary by the program and by EPO.
- Vouchers for travel expenses incurred on an Epi-Aid investigation should be submitted to EPO at the same time as the EPI-2 Report. All Epi-Aid travel vouchers must be approved by the EPO Administrative Officer, who will then forward them to the CDC Financial Management Office.

EPI-AID NUMBERS

EPO assigns an Epi-Aid number to each epidemiologic investigation supported by Epi-Aid travel funds. Epi-Aid numbers are assigned sequentially. As the initiator, you should request a number when the EPI-1 Report is ready to be typed in draft form.

When requesting an Epi-Aid number, provide EPO with the nature and location of the health problem, the principal investigator's name, the officer's supervisor's name, date of departure, and expected date of return.

Sample Epi-Aid Number: EPI-90-10 (90 represents the fiscal year;
 10 represents the number assigned by EPO)

EPI-1 Report Number: EPI-90-10-1

EPI-2 Report Number: EPI-90-10-2

If the proposed investigation is canceled or postponed, or if the EPI-1 Report cannot be prepared the same day the number is assigned, call EPO so that the assigned number can be released.

THE REQUEST

DOMESTIC

OUTLINE AND CHECKLIST FOR ORIGINATING EPI-AID MISSIONS

SITUATION:

Your office is contacted with a request for assistance from a state/local health department. Your supervisor tentatively agrees to provide that assistance and assigns you to be the responsible officer for the investigation.

SAME-DAY RESPONSE:

- Call the EPO (Commercial 404-639-3182; FTS 404-236-3182) for an Epi-Aid number and preliminary approval (the request may require further discussion with EPO).
- Complete the draft EPI-1 Report.
- Inform your support staff member of the correct mailing list for the EPI-1 Report, including the appropriate regional office and state health department personnel.
- After the draft EPI-1 Report has been edited and cleared by your CIO, electronically transmit it to EPO for final approval.
- Revise the EPI-1 Report per EPO's instructions, obtain signatures (or instruct your support staff to do so) from all persons designated on the EPI-1 Report, and send the approved final copy to the CDC Publications Management Office, MASO, Bldg 1, Room B 122, with the accompanying form (CDC 0.103A, Request for Printing Services), for printing and distribution (see ILLUSTRATION).

- If an Epi-Aid mission is canceled, notify EPO immediately so the number can be released for reassignment.
- Notify the regional offices of the Epi-Aid by contacting the Director, Division of Preventive Health Services, of the appropriate region. Include the name, title, region number, and date notification was made in the report.
- When the request originates from a state to which an EIS Officer is assigned, the request should be discussed with the Division of Field Services, EPO.

THE REQUEST

DOMESTIC (NON-BUSINESS HOURS)

SITUATION:

You are requested to go out on an Epi-Aid during non-business hours.

RESPONSE:

- After the Epi-Aid investigation has been approved, purchase your airline or other ticket with a credit card, cash, or Government Transportation Request (GTR). Make every effort to ensure that the lowest fare possible is obtained.
- When on official government temporary duty travel, obtain the government rate for expenses whenever possible. Carry your Public Health Service identification (PHS ID) card in order to obtain these rates.
- Notify the Administrative Office, EPO, and your CIO's Administrative Office via Async (or the following morning) so a confirmation travel order can be issued.
- Before you leave, complete and sign an Advance of Funds (SF-1038) so your Administrative Office can process the request the following business day. You can arrange to have the funds deposited in your personal banking account, mailed to you, or held for you at your duty station.
- In order to be reimbursed for expenses, process a travel voucher through EPO's Administrative Office to CDC's FMO.

THE REQUEST

INTERNATIONAL

International Investigations. Requests for support of international investigations should come to EPO only after they have been discussed with IHPO which will explore other possible sources of support for the Epi-Aid. If appropriate, the CDC program and IHPO will then request EPO assistance through the Epi-Aid mechanism.

IHPO is responsible for communicating information regarding requests for international epidemiologic assistance to appropriate Health and Human Services (HHS), State Department, Agency for International Development, and other international agency officials, and for obtaining any necessary approvals from these agencies.

SITUATION:

Your office receives a request for epidemiologic assistance from an international source.

RESPONSE:

- Contact Bob Baldwin, Ext. 0225, to determine if international funds are available. The International Health Program Office (IHPO) will explore other possible sources of financial support for the assistance.
- If international funds are unavailable, the CDC program and IHPO may then request EPO's assistance through the Epi-Aid mechanism.

BEFORE LEAVING

TRAVEL ORDERS

Epi-Aid Travel. Travel order numbers are issued by the EPO Administrative Office (call Commercial 404-639-3604; FTS 404-236-3604). Travel costs are charged against the appropriate CIO Epi-Aid account number.

THE EPI-1 REPORT

Purpose. The EPI-1 Report informs appropriate individuals (CDC Director, CDC professional staff, and state and territorial epidemiologists) of the suspected health problem in brief, clear, factual, and logically organized language (see ILLUSTRATION).

Distribution. Include the following mailing keys on Epi-1 Reports:

- WF-1 1st and 2nd year EIS Officers
- WF-2 EPO professional staff
- WF-3 CDC professional staff
- ZW All state epidemiologists

Note: Include names, titles, and mailing addresses of all other individuals who are to receive copies of Epi-Aid documents below the list of mailing keys. It is the originating office's responsibility to mail copies to all persons not included on CDC mailing keys.

The EPI-1 Report is addressed to the CDC Director. It informs appropriate individuals of the suspected health problem and is written by the investigating officer before departing the duty station. **Because of the need to convey the information to public health officials, the DRAFT EPI-1 Report must be submitted to EPO the same day the Epi-Aid number is assigned.** The EPI-1 Report should be sent to EPO electronically (directed to Jean Heslin, or other designated EPO staff member). There is currently a WANG glossary for the EPI-1 Report; contact your WANG Systems Administrator for instructions. A WordPerfect merge document is also available.

Draft EPI-1 Reports are reviewed and approved by EPO. EPO notifies the originator of any needed changes. Upon EPO approval, the EPI-1 Report is prepared in final form by the originating office and delivered as soon as possible to the CDC Publications Management Office, MASO, Bldg 1, Room B122, with a completed form (CDC 0.103A, Request for Printing Services) (see ILLUSTRATION).

Notification of the Regional Office. The originating office is responsible for notifying the Director, Division of Preventive Health Services, in the appropriate regional office.

Notification of the State Health Department. Most requests for epidemiologic assistance are received by CDC from state health officials. However, some Epi-Aid requests may come from other sources (e.g., Indian Health Service, Federal penitentiary, hospital, cruise ship). In such situations, the CIO handling the investigation is responsible for informing the appropriate state epidemiologist. Mention of the discussion conducted by CDC and the state must be included in the EPI-1 Report.

Co-Investigating Officers. Occasionally, Epi-Aid requests involve participation of more than one EISO and more than one CDC CIO. When preparing the EPI-1 Report, include names, titles, and organizational affiliations of all participating EISOs. Supervisors of participating EISOs are expected to review the draft EPI-1 Report and sign the final EPI-1 Report.

IN THE FIELD

DATA COLLECTION

Clearance from the Office of Management and Budget (OMB) is required when collecting data from an Epi-Aid investigation. CDC has obtained OMB clearance for emergency situations. In addition to financial support, the Epi-Aid mechanism provides that OMB prior approval of specific investigations is not required provided that data collection does not exceed 30 days. Questions regarding data collection should be addressed by the CDC Evaluation Officer, Office of Program Planning and Evaluation. If CDC is responsible for the collection of data, a copy of the instrument to be used must be provided to the CDC Evaluation Officer, along with a completed form CDC 0.746 (see ILLUSTRATIONS).

HUMAN SUBJECTS REVIEW

Human subjects review by an Institutional Review Board (IRB) may or may not be required for an Epi-Aid investigation, depending on whether the investigation is "research" involving human subjects. It is not always clear when IRB review is required according to various written rules and guidelines, but it is important that the intent and spirit of the regulations on protection of human subjects be followed. An emergency public health response to determine the cause and/or extent of a particular, acute, current health problem in a community and to develop plans for its control usually would not be considered research, since the investigation is the public health equivalent of individual doctor-patient situations in which the community, as "patient", presents with a health problem which the CDC and other health agencies, as "physician", are expected to diagnose via the investigation, and control ("treat") without delay.

When the need for IRB review is unclear, the Human Subjects Review (HSR) Contact Persons within the CIOs should be consulted. In those instances where IRB review is determined to be necessary and yet time is critical (e.g., specimens must be collected within a few days or they would be of little use), the HSR Contact Person will take steps to expedite the human subjects review process. CDC Manual Guide No. 11, Protection of the Individual as a Research Subject, includes information helpful for writing a protocol, such as an outline of what should be included, and the basic elements of informed consent.

IN THE FIELD

CRUISE SHIP INVESTIGATIONS

Cruise Ship Epi-Aid Investigations. When conducting an investigation aboard a cruise ship, refer to the following forms: Crew Survey Questionnaire (CDC 75.12A) and Passenger Survey Questionnaire (CDC 75.12B) (see ILLUSTRATIONS). For additional information, contact Thomas N. Hunt, Chief, Vessel Sanitation Program, Center for Health Environment and Injury Control, Miami Florida Station, (FTS: 350-4307, Commercial 305-350-4307).

UPON RETURNING

SITUATION:

You return to your duty station after conducting an Epi-Aid investigation.

RESPONSE:

- Within 14 calendar days after you return to your duty station, prepare the EPI-2 Report. Satisfy review/clearance requirements as directed by your CIO. Copies of the EPI-2 Report should be provided to:
 - 1) Director, CDC
 - 2) Deputy Director, CDC
 - 3) Assistant Director, Washington Office
 - 4) Director, Office of Public Affairs
 - 5) Director, Epidemiology Program Office
 - 6) EIS Officer's CIO Director, Division Director, Branch Chief, etc.
 - 7) Director, Division of Field Services, EPO
 - 8) Director, Division of Preventive Health Services, Regional Office
 - 9) Appropriate field contacts
 - 10) Jean Heslin, EPO (10 copies)
- Provide your support staff member with all documents needed for fiscal accounting for reimbursement of travel and related expenses and send the travel voucher to the EPO Administrative Officer, M/S CO8, for approval/processing and forwarding to the Financial Management Office (FMO).
- Vouchers for travel expenses incurred on an Epi-Aid investigation should be submitted to EPO at the same time as the Epi-2 Report.
- Contact the EIS Office, EPO, Patsy Bellamy, (Commercial 404-639-3588; FTS 404-236-3588) to schedule a 2-3 minute oral report, as well as a full-length oral report, of the investigation to be made at the Tuesday Morning Seminar.

UPON RETURNING

THE EPI-2 REPORT

The EPI-2 Report is a scientific report providing the early final results of the investigation (i.e., within 14 days) to the requesting State/local/international officials. Immediately upon completing a field investigation, the EIS Officer and other investigators should write an EPI-2, which is, in effect, a trip report. For most Epi-Aids, a trip report of 3-5 pages will be sufficient. The report should describe (1) what was known about the problem at the beginning of the investigation, (2) what was done in the field, including recommendations, and (3) what is pending or planned for the future. The emphasis should be on the field investigation.

The trip report should follow this outline:

Abstract or summary.

Background--what was known and how the Epi Aid started.

Methods--what was done in the field.

Results--what was found in the field.

Discussion--what the results (and other information available at that time) mean.

Recommendations and actions--what recommendations were provided upon leaving the field, and what additional activities or studies are in progress or planned (viral cultures, multivariate analysis, etc.).

The trip report must be addressed to the CDC Director and be cleared/signed by the supervisor of the EIS Officer (see ILLUSTRATION). The trip report will not receive the same wide distribution (first and second year EIS Officers, EPO professional staff, CDC professional staff, and all state epidemiologists). However, copies of the EPI-2 Report should be provided to:

- 1) Director, CDC
- 2) Deputy Director, CDC
- 3) Assistant Director, Washington Office
- 4) Director, Office of Public Affairs
- 5) Director, Epidemiology Program Office
- 6) EIS Officer's CIO Director, Division Director, Branch Chief, etc.
- 7) Director, Division of Field Services, EPO
- 8) Director, Division of Preventive Health Services, Regional Office
- 9) Appropriate field contacts
- 10) Jean Heslin, EPO (10 copies)

A list of recently completed Epi-2 Reports will be published in the EIS Bulletin. These Epi-2 Reports will be made available upon request.

Published Morbidity and Mortality Weekly Report (MMWR) and journal articles, cleared manuscripts, and technical reports cannot be substituted EPI-2 Reports. There is currently a WANG glossary for the EPI-2 Report; contact your WANG Systems Administrator for instructions. A WordPerfect merge document is also available.

Use of Personal Identifiers. The CDC Office of General Counsel advises the following regarding the use of personal identifiers in EPI-2 Reports:

Generally, personal identifiers of cases who are the subject of reports, such as the EPI-2 Report, should not be used unless they are necessary for public health purposes. Although these reports are considered internal documents with limited distribution, they are not necessarily exempt from disclosure under the Freedom of Information Act or the Privacy Act. Inadvertent releases of these reports are possible and could constitute an invasion of the subject's privacy. Additionally, if the subject is deceased, CDC would face difficulty in preventing the release of the subject's name pursuant to a request made for the reports under the Freedom of Information Act. Additionally, the author's inclusion of a patient's name in such reports substantially increases the likelihood that the author may be subpoenaed in litigation involving the patient.

UPON RETURNING

THE EPI-3 REPORT

The EPI-3 Report is a scientific report providing additional findings of the investigation, if warranted, and is issued at the discretion of the CIO responsible for conducting the Epi-Aid investigation. It can be a published MMWR article, journal article, or a technical report.

Distribution is the same as for the EPI-1 Report: Include the following mailing keys on Epi-3 Reports:

- WF-1 1st and 2nd year EIS Officers
- WF-2 EPO professional staff
- WF-3 CDC professional staff
- ZW All state epidemiologists

Note: Include names, titles, and mailing addresses of all other individuals who are to receive copies of Epi-Aid documents below the list of mailing keys. It is the originating office's responsibility to mail copies to all persons not included on CDC mailing keys.

The originating office should prepare an EPI-3 Report in final form and deliver it to the CDC Publications Management Office, MASO, Bldg 1, Room B122, with a completed form, (CDC 0.103A, Request for Printing Services) (see ILLUSTRATION).

UPON RETURNING

THE TRAVEL VOUCHER

Provide your support staff member with all documents needed for fiscal accounting for reimbursement of travel and related expenses and send the travel voucher to the EPO Administrative Officer, M/S CO8, for approval/processing and forwarding to the Financial Management Office (FMO)

Travel vouchers should be submitted to EPO at the same time as the EPI-2 Report.

All Epi-Aid travel vouchers must be approved by EPO's Administrative Officer, who will be responsible for forwarding to CDC's FMO. The Epi-Aid number is included on all travel documents.

When a return visit is needed to complete the Epi-Aid investigation and Epi-Aid funding is desired, approval must be granted by EPO. Contact Jean Heslin, or other designated EPO staff member, 404-639-3182, explaining the need for a return visit.

EPI-AID ORAL PRESENTATIONS AND UPDATES

The Professional Staff Seminars, sponsored by the Epidemiology Program Office and held on Tuesdays at 9:00 a.m., provide EIS Officers with several opportunities. These include 1) presenting methods and results of recently-conducted epidemiologic investigations for peer review as the feature presentation; 2) presenting brief reports of epidemiologic missions just completed (particularly, Epi Aids); and 3) offering comments, questions, and constructive criticism from the audience.

Presenting Results of Completed Investigations

The following tips are provided because all of you will be presenting at some time or another. As you probably know, the audience is the epidemiology community at CDC, which includes staff epidemiologists, Preventive Medicine Residents, EIS Officers, interested biostatisticians and other CDC staff, and MPH/epidemiology students from Emory University. Most of the epidemiologists are physicians. The seminars usually begin with about 15 minutes of brief reports from the field. The feature presentation then usually runs for about 30 minutes, followed by a question and answer period. After the seminar, the featured presenter will be invited to spend an additional 10 minutes or so in the auditorium with the class of Emory MPH students who listen to and discuss the seminar each week.

The Professional Staff Seminars are held in one of two auditoriums: Auditorium A, which seats about 100 people, or Auditorium B which seats about 450 people. Both are equipped for either overheads or slides. Because the auditoriums are large, the writing on overheads should be at least twice the type size of a standard typewriter.

The emphasis of the main presentation should be epidemiology. The main presentation runs for 20-30 minutes, followed by a question and answer period. Slides and/or overheads can be used. The seminars are recorded on audio cassettes and mailed weekly to EIS Officers not based in Atlanta. The following recommendations should be followed:

- Speak directly into the microphone.
- Go over the slides slowly.

- Read and describe the titles, headings, etc., so that the listener will know what the figures refer to.
- Request that those asking questions speak into the microphone and/or repeat questions not spoken into the microphone.
- Provide the EIS Office with hard copies of all tables, graphs, and figures presented on slides (either the day of the seminar or within 2 days after the seminar).
- Consider a practice session with your supervisor and others in your Branch.

Officers are expected to provide brief oral updates on their investigations immediately following their return to the duty station. Investigators assigned outside of Atlanta can provide an update by telephone.

Because of the limited amount of time (15 minutes) for reports and announcements, the following guidelines should be followed when providing an Epi-Aid update:

- Present the report within 2-3 minutes. The health problem, location, and concise statement of findings and recommendations should be provided. Most officers find it helpful to write out the text in advance (1-1/2 double spaced pages equals 2-3 minutes).
- Preliminary results of the investigation should be described even if results are pending completion of statistical and lab analyses.
- Visuals (transparencies, slides) should not be used unless absolutely essential.

Contact the EIS Office, EPO, Patsy Bellamy, (Commercial 404-639-3588; FTS 404-236-3588) to schedule a 2-3 minute oral report, as well as a full-length oral report of the investigation to be made at the Professional Staff Seminar.

RELEASE OF EPI-AID REPORTS TO OUTSIDE

Epi-Aid Reports (EPI-1 Report, EPI-2 Report, and any subsequent Epi-Aid reports) can be released to persons outside CDC when requested under the Freedom of Information Act (FOIA). A requestor must be informed to put the request in writing to the CDC Freedom of Information Officer for processing. A response, with reports if appropriate, will be prepared according to established FOIA guidelines. For additional information concerning the release of Epi-Aid reports, contact Jean Heslin, or other designated EPO staff member, EPO, (Commercial 404-639-3182; FTS 404-236-3182), or the CDC Office of Public Affairs, (Commercial 404-639-3286; FTS 404-236-3286).

GUIDELINES FOR SUPPORT STAFF

1. Type the EPI-1 Report according to instructions provided in this booklet.
2. Electronically transmit the draft EPI-1 Report to EPO for review/approval. Send to Jean Heslin, or other designated EPO staff member; notify EPO that the EPI-1 Report is being sent; (Commercial 404-639-3182; FTS 404-236-3182).
3. In the EPI-1 and EPI-2 Reports list names in full, including initials.
4. Obtain the necessary CIO clearances--including editorial offices, if applicable--before submitting drafts to EPO for approval.
5. ALWAYS include the following distribution section beneath the signature blocks on both the EPI-1s and EPI-3s:

DISTRIBUTION:

Mailing Keys: WF-1,-2,-3; ZW

Include names and addresses of other persons to receive copies of the report, and type this information beneath the mailing key information. Note: It is the responsibility of the initiating office to mail copies to persons not included on the mailing keys. The CDC Distribution Section, MASO, is only responsible for mailing copies to persons included on the mailing keys.

6. Ensure that the officer has notified the appropriate state health officials and the regional office staff and that this information (including date of notification) is included in the EPI-1 Report.
7. The EPI-1 Report should be processed expeditiously. The initiating office is responsible for delivering the camera-ready copy and printing requisition to Publications Management. Obtain EIS insignia paper for EPI-1 Reports by calling Jean Heslin, or other designated EPO staff member (Commercial 404-639-3182; FTS 404-236-3182). Same-day processing is possible if your copy and requisition reach Publications Management by 3:00 p.m.
8. A copy of the EPI-2 Report should be submitted to EPO within 14 calendar days after returning from the duty station, and should be attached to the travel voucher. Obtain EIS insignia paper for EPI-2 Reports (two footed) by calling Jean Heslin.

9. EPI-3 Reports should receive the same distribution as the EPI-1 Report. Obtain EIS insignia paper for EPI-3 Reports (three footed) by calling Jean Heslin.
10. Obtain signatures of all appropriate individuals on the final copy.
11. Ensure that the revisions requested by EPO are included in the final version of the EPI-1 report.

ABBREVIATIONS/ACRONYMS

Centers for Disease Control (CDC)
Communicable Disease Center (CDC)
Epidemic Intelligence Service (EIS)
Center/Institute/Office (CIO)
EIS Officers (EISOs)
Epidemiology Program Office (EPO)
Epidemiologic Assistance (Epi-Aid)
Field Epidemiology Report (FER)
Financial Management Office (FMO)
Freedom of Information Act (FOIA)
Federal Telecommunications System (FTS)
Government Transportation Request (GTR)
Institutional Review Board (IRB)
International Health Program Office (IHPO)
Office of Management and Budget (OMB)
Professional Experience Guidelines (PEGs)
Public Health Service identification (PHS ID)

Forms:

Advance of Funds (SF-1038)
Request for Printing Services (CDC 0.103A)
Crew Survey Questionnaire (CDC 75.12A)
Passenger Survey Questionnaire (CDC 75.12B)

Creating an EPI-1 from a Glossary in Wang Word Processing

Create a new document in Word Processing.
Complete Document Summary Page as follows:

"Document Name:"	[Enter EPI-AID number issued by EPO]
"Operator:"	[As desired by CIO]
"Author:"	[Enter first and last name of a valid Electronic Mail Service (EMS) user]
"Comments:"	[As desired by CIO]

Attach EPI-1 glossary as follows:

While in the document, press "COMMAND" then "GL". Enter the glossary document ID assigned by your Wang System Administrator. Screen will indicate "Attachment Successful."

Press "GL" then "e".

Correct format line will be created, and the system will print standardized text automatically. System will pause when text is to be entered by the operator. "Prompts" will be displayed in the upper right-hand corner of the screen to assist in completing the form. Entries which are self explanatory will have no prompts.

Enter only the necessary text:

It is not necessary to enter spaces, tabs, or returns unless they are needed within an entry.

After entering the required text at each entry, press "EXECUTE." The system will continue to print standardized text and pause for operator entry of text.

EXECUTE	key should be used only to continue recalling the glossary;
CANCEL	key should only be used when you wish to exit from the glossary without continuing through to the end

EDIT KEYS

(SEARCH, REPLACE, COPY, MOVE, INSERT, AND DELETE) cannot be used while running a glossary. It is suggested that if an error is made while entering text you continue through to the end of the glossary, then go back and insert, delete, replace, or otherwise edit the document. At the end of the document, the system will indicate "GLOSSARY COMPLETED."

PAGINATION

The glossary does not paginate the document, since each document will contain varying amounts of text. After the document is completed, paginate it with a page length between 51 and 55 lines, then press "GL" and "2" (cursor can be anywhere in the document). This will create a heading for the second page.

Document should now be ready for transmission to EPO via electronic mail. (NOTE: The "Author" field of the Document Summary page must contain the first and last name of a valid EMS user.)

Creating an EPI-1 With Screen Merge in WordPerfect

Copy the merge document "Epi-1.pf" into the subdirectory to which WordPerfect defaults for documents.

Starting Screen: The screen is blank.

Press Control/F9

Press M

At the "Primary File" prompt, enter "epi-1.pf" and press enter.

At the "Secondary file prompt" press enter.

Standardized text will automatically appear and the cursor will pause at the first field to be completed. Enter only the necessary text--do not enter spaces, tabs, or returns unless they are needed within the entry.

After entering the required text at each entry, press "F9" to continue through to the end of the document.

ILLUSTRATIONS



Centers for Disease Control



EPI-AID :
DATE :
TO : Director, Centers for Disease Control
SUBJECT :
LOCATION :

Nature of Problem:

Date Problem First Identified by the Requesting Agency:

Date of Initial CDC Contact:

Initial CDC Contact:

Caller/Correspondent:

Source of Invitation:

CDC Staff Contacted

CIO/Division/Branch/Section

Name/Title

Other Persons Contacted

State/Local Health Officials:

Other (Non-CDC) Federal Officials:

Others:

Regional Office:

Nature and Timing of Response:

Branch/Division/CIO Providing Primary Oversight of the Investigation:

CIO Sharing Oversight:

CDC Supervisor Responsible for Technical Supervision of Investigator and EPI-2 Report:

Objectives of the Epi-Aid Mission:

Signature
Title
Division, CIO



EPI-AID: EPI-90-54-1
DATE: May 4, 1990
TO: Director, Centers for Disease Control
FROM: Director, Division of Viral and Rickettsial Diseases (DVRD), CID
SUBJECT: Outbreak of Hepatitis A in an Elementary School
Location: Georgia

Nature of Problem:

From April 19, 1990, through May 2, 1990, three adult staff and seven children at one elementary school in Georgia contracted hepatitis A. Among the children, cases occurred in kindergarten and grades one through five. Preliminary investigation found one foodhandler at the elementary school with a history of diarrheal illness on March 19, 1990. Serum samples were collected from all foodhandlers and results of IgM antibody to hepatitis A virus are pending.

Date Problem First Identified by the Requesting Agency:

May 1, 1990

Date of Initial CDC Contact:

May 1, 1990

Initial CDC Contact:

Gary C. Schatz, Ph.D., Health Officer, Hepatitis Branch (HB), DVRD, CID

Caller/Correspondant:

Dave Smith, B.S., Infectious Disease Epidemiologist, Georgia State Health Department

Source of Invitation:

R. Keith Sikes, D.V.M., M.P.H., State Epidemiologist, Georgia State Health Department

CDC Staff ContactedCIO/Division/Branch/SectionName/Title

CID, DVRD, HB

Harold S. Margolis, M.D., Chief

CID, DVRD, HB, ES

Gary C. Schatz, Ph.D., Health Officer

Miriam J. Alter, Ph.D., Chief

CID, DBD, EDB, ES

Manette T. Niu, M.D., EIS Officer

Robert V. Tauxe, M.D., Chief

Michael Miller, Epidemiology

Elective Student

Other Persons Contacted

State/Local Health Officials:

None

Regional Office:

Max Pesses, Director, Division of Preventive Health Services, HHS Region IV, was notified on May 4, 1990.

Others (Non-CDC) Federal Officials:

None

Others:

None

Nature and Timing of Response:

Dr. Niu and Mr. Miller departed on May 4, 1990 to join local health officials in the investigation.

Branch/Division/CIO Providing Primary Oversight of the Investigation:

HB/DVRD/CID

Branch/Division/CIO Sharing Oversight:

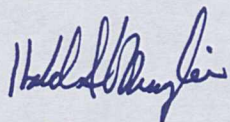
None

CDC Supervisors Responsible for Technical Supervision of Investigator and EPI-2 Report:

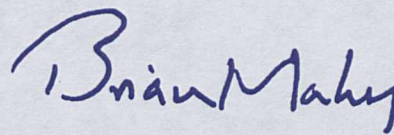
Miriam J. Alter, Ph.D

Objectives of the Epi-Aid Mission:

To identify the cause of the outbreak, to assist in its control, and determine the time period for which viral shedding persists.



Harold S. Margolis, M.D.
Chief, HB, DVRD, CID



Brian W.J. Mahy, Sc.D., Ph.D.
Director, DVRD, CID

DISTRIBUTION: Mailing Keys WF-1,-2,-3: ZW

Note: List names and mailing addresses of appropriate field contacts that are to receive copies of the report. IT IS THE RESPONSIBILITY OF THE INITIATING OFFICE TO MAIL COPIES TO PERSONS NOT INCLUDED ON THE MAILING KEYS.



EPI-AID : 90-28-2

DATE : April 19, 1990

TO : Director, Centers for Disease Control

FROM : David L. Swerdlow, M.D., EIS Officer, Enteric Diseases Branch,
Division of Bacterial Diseases, CID
Robert C. Brady, D.V.M., EIS Officer, Division of Field Services,
EPO
Bradley A. Woodruff, M.D., M.P.H., Preventive Medicine Resident,
Enteric Diseases Branch, DBD, CID

SUBJECT : Outbreak of Hemorrhagic Colitis

LOCATION: Cabool, Missouri

DATE OF DEPARTURE: January 9, 1990

DATE OF RETURN : February 17, 1990

ABSTRACT

From December 15, 1989 to January 20, 1990, 240 cases of diarrhea (85 bloody) occurred in visitors or residents of the city of Cabool and Burdine Township, Missouri. Escherichia coli O157:H7 resistant to sulfisoxazole, tetracycline, and streptomycin was isolated from 21 stool specimens. There were 34 hospitalizations, three deaths, and two cases of hemolytic uremic syndrome. In a case-control study of 53 cases and 106 age-matched controls, ill persons drank significantly more municipal water than well persons (7.8 vs 6.1 cups per day, $p < 0.05$). No food vehicle, including hamburger, beef, or milk, the vehicles found in prior outbreaks, was associated with illness. In surveys of 968 households, persons living inside the city (municipal water) were significantly more likely to have bloody diarrhea between December 25 and January 5 than were persons living outside the city (private well water) (relative risk 18.2, 95% confidence interval = 2.5-135.1). Among persons surveyed outside the city, those with onset of illness during the peak of the outbreak drank significantly more municipal water than did well persons (1.5 vs 0.3 cups per day, $p < 0.05$). Households inside and outside the city did not differ in their restaurant eating or grocery store shopping habits. Two large water main breaks and over 40 water meter

replacements occurred shortly before the peak of cases. The number of new cases declined rapidly after January 5, when residents were instructed to boil their drinking water. The water was chlorinated on January 12, and no new cases occurred after January 18. Investigation of possible sources of contamination of the city water system continues. Permanent chlorination of the city water was recommended. This was the largest outbreak of E. coli 0157:H7 infections described to date, the first due to a multiply-resistant organism, and the first associated with waterborne transmission.

BACKGROUND

On January 8, 1990, Beverly Payne, Chief, Microbiology Department, State Public Health Laboratory, Missouri, informed Joy G. Wells, M.S., Chief, Epidemiologic Investigations Laboratory, Enteric Diseases Branch (EDB), Division of Bacterial Diseases (DBD), CID of the isolation of Escherichia coli 0157 from stool specimens collected during the investigation of an outbreak of bloody diarrhea in Cabool, Missouri. H. Denny Donnell, Jr., M.D., M.P.H., State Epidemiologist, Missouri Department of Health, invited the Enteric Diseases Branch of the Center for Infectious Diseases to assist in the investigation, and on January 9, Drs. David L. Swerdlow and Bradley A. Woodruff, Medical Epidemiologists, EDB, departed for Cabool, Missouri to join Dr. Robert C. Brady, EIS officer, Division of Field Services, EPO in the investigation.

On January 4, 1990, the Texas County Health Department learned of 10 residents of Cabool with bloody diarrhea and abdominal cramps. The Missouri Department of Health began an investigation on January 5. Because all initial patients, including several nursing home residents, lived in the city of Cabool, on January 5 a warning to residents to boil their drinking water was issued, and samples of water were taken for analysis at the State laboratory. Stool specimens sent to the Mid-American Laboratory did not grow any recognized pathogens, but sorbitol-negative colonies identified on MacConkey-sorbitol medium were sent to the State laboratory and identified as E. coli 0157 on January 8.

Cabool is a city in rural southern Missouri within the township of Burdine, which is in Texas County. In the 1980 census, Burdine Township had 3126 inhabitants, with 2090 people within the Cabool city limits. The borders of Burdine Township are up to 6-9 miles from the Cabool city limits. Between December 12 and 24, the region suffered from extreme cold with temperatures never higher than 32°F, and lows to -19°F. Two large water mains broke on December 23 and December 26, and over 40 water meters were replaced between December 14 and December 27 because of freezing of lines or meter failure.

MATERIALS AND METHODS

Case Definition

A case was defined as illness with onset between December 15, 1989 and January 20, 1990, in a visitor or resident of Burdine Township with 1) three or more bloody loose stools in a 24-hour period, or 2) three or more nonbloody loose stools in a 24-hour period, lasting 24 hours or more, with abdominal cramps.

Case Finding and Surveillance

To find cases, we contacted all physicians in Texas County and the local hospital daily. We used news media appeals to ask persons with diarrhea to contact the health department, asked case-patients to name other ill persons, and called the six regional hospitals. Stools were collected for culture from all newly recognized cases of bloody or severe diarrhea.

Health officials in the eight surrounding counties administered a questionnaire by telephone to physicians and to hospital and laboratory personnel in their counties, asking about cases of severe or bloody diarrhea seen during the previous 3 months, as well as hospitalizations and serious sequelae of diarrhea. Cary-Blair transport medium was distributed to these health departments to facilitate culturing for E. coli O157:H7. All stool specimens from Texas County are routinely cultured at the Mid-American Laboratory in West Plains, Missouri, a regional laboratory serving 12 counties. The records of this laboratory, and two small hospital-based laboratories in neighboring counties, were examined to seek additional cases and to compare the number of cases of bloody diarrhea during December and January with prior months and with the same period one year earlier.

Case-Control Study

To evaluate possible vehicles associated with illness, we used trained interviewers making home visits between January 13 and 20 to conduct a matched case-control study. Case-patients were residents of Burdine Township meeting the case definition whose onset of diarrhea was between December 15 and January 13 (the day the case-control study began). Each case-patient was the first ill person in the household. Nursing home patients were excluded. Two neighborhood- and age-matched controls were selected for each case. For case-patients aged 1-5 and 6-14 years, controls were selected from the same age group. For those older than 14 years, the control was within 20 years of the case-patient's age, but older than 14 years. Controls were found by going door-to-door in a specified order. Controls were excluded if any member of that household had been ill with diarrhea, vomiting, or cramps since December 15. Case-patients were asked about food and water exposures and restaurants visited in the 7 days before their illness began. Controls were asked about the same exposures for the 7 days before the date their matched case-patient's illness began.

Cohort Studies

Questionnaires were distributed to employees at a dairy processing plant and a nursing home located in the city. The nursing home was on city water; the dairy plant was not. Employees were asked questions about food and water consumption at work, at home, and at restaurants in the city of Cabool.

Household Surveys

Using a tax roster which listed the names of all township residents who owned a car, farm equipment, or livestock, we conducted a systematic random survey of township households within and outside the city limits between January 26 and February 4. Because over 90% of the initial 107 households contacted outside the city had telephones, we limited the survey to households with telephones. Unreachable households (three calls per day each one-half hour

apart for 2 successive days) were excluded, and the next household on the tax list was called. Respondents were over 18 years of age, and answered survey questions about themselves, other family members under 18 years of age, and unavailable family members. All available adult family members were questioned separately. Respondents were asked to provide a family roster and information concerning diarrheal illness in family members since December 15, 1989. Information was obtained about water drinking between December 25 and January 5 (the day of the order to boil water) for family members without diarrhea, and between December 25 and the day of onset of illness for family members with diarrhea.

Fifty households were randomly selected from the households surveyed inside the city, and fifty from those outside the city. Respondents were asked to provide information on restaurant eating and grocery shopping practices between December 25 and January 5.

Laboratory Investigation

Human stool samples were processed by the Missouri State Public Health Department Microbiology Laboratory and by the Mid-American Laboratory in West Plains. Determination of the H antigen and antibiotic resistance patterns of E. coli 0157 isolates was done at the Enteric Diseases Laboratory at CDC. Rectal swabs from cows were cultured for E. coli 0157:H7 at the Missouri State Public Health Department Microbiology Laboratory.

Food, water, and ice samples, and waste water treatment samples from the dairy processing plant were cultured at the Missouri State Public Health Department Environmental Laboratory and at the Food Research Institute, University of Wisconsin, Madison, Wisconsin in the laboratory of Dr. Michael Doyle. Water samples collected between February 12 and 15 were also cultured at the Environmental Protection Agency (EPA) in Cincinnati, Ohio. Coliform counts were determined on water samples collected by city officials and the Missouri Department of Natural Resources. On January 15, after E. coli 0157:H7 had been isolated from patients stools, colonies that had been isolated while performing coliform counts between January 8 and 13 were examined for E. coli 0157:H7. Water samples sent by CDC and the Missouri Department of Health to the State Environmental Laboratory after January 15, and all samples sent to the EPA, were filtered, then cultured on MacConkey-sorbitol medium as well as on routine media. Water samples sent to the Food Research Institute were filtered, enriched, and cultured, and the plates were hybridized with a DNA probe for Shiga-like toxin II.

Environmental Investigations

The two major grocery stores, the six restaurants, and the nursing home kitchen facilities in Cabool were inspected by local and state sanitarians. All food sources for each of these facilities were determined. The municipal water system, including wells, storage tanks, and the maintenance and distribution system, was evaluated by the Missouri Department of Natural Resources, regional and state sanitarians, the EPA, and CDC. The sewage system, including collection and lagoon treatment facilities, was similarly inspected. Sites of possible cross-connections between the city water system

and the sewer system, or between the city water system and the three dairy farms or the dairy processing plant in the city were evaluated. The Food and Drug Administration (FDA) investigated the dairy processing facility in Cabool and the dairy in Springfield, Missouri where all milk sold in southern Missouri is processed.

Statistical Analysis

Cornfield 95% confidence limits were used for odds ratios, and Taylor series 95% confidence limits were used for relative risks. Comparison of proportions between groups was done using chi-square analysis with the Mantel-Haenszel correction, and the Wilcoxon two-sample test was used for comparison of continuous variables. Conditional logistic regression was used for analysis of case-control data. All p values were 2-tailed.

RESULTS

Population and Clinical Data

Between December 15 and January 20, 240 persons had diarrhea that met the case definition, of which 85 (35%) had bloody diarrhea. Residents of Cabool accounted for 68 (80%) of the 85 bloody cases and 72 (46%) of the nonbloody cases (Figure 1). Of the 17 persons with bloody diarrhea who did not live in Cabool, 10 lived in Burdine Township and the remaining seven had visited or worked in Cabool. Of the 83 persons with nonbloody diarrhea who did not live in Cabool, 65 lived in Burdine Township and the other 18 had visited or worked in Cabool (Figure 2).

Using population figures from the 1980 census, the attack rate within the city was 6.7% (140/2090) for all cases and 3.3% (68/2090) for bloody diarrhea. For cases inside the city, attack rates by age group were: age < 5 years, 7.3% (12/164); age 5-17, 4.4% (17/387); age 18-64, 4.5% (49/1078); and age > 64, 7.2% (33/461). Age was not recorded for 29 cases. The attack rate for persons at the extremes of age, < 5 or > 64 years (7.2%), was significantly higher than that for persons age 5-64 (4.5%, $p < 0.05$).

The mean age of all case-patients was 38 years, and 63% were female. The mean $\pm$ SD maximum daily number of stools was 8.4 ± 5.8 , and the mean duration of diarrhea was 3.9 ± 3.5 days. Inside the city, the proportion of cases with bloody diarrhea increased with increasing age: age < 5 years, 33% (4/12); age 5-17, 41% (7/17); age 18-64, 49% (24/49); and age > 64, 79% (26/33) ($p < 0.05$, by chi-square for linear trend).

This infection directly caused 34 hospitalizations and three deaths. One additional person, whose initial hospitalization was extended because of pneumonia requiring mechanical ventilation, died of infarcted bowel 2 weeks after her hospital discharge. Two patients developed hemolytic uremic syndrome, a known serious sequela of infection with this organism.

Case-Control Findings

Of the 53 case-control triplets, 35 case-patients had bloody diarrhea and 18 had nonbloody diarrhea. The onset of diarrhea was between December 19 and

January 12. Case-patients drank significantly more cups of municipal water per day in the 7 days before illness began than did controls (7.8 vs 6.1, $p < 0.05$.)

Forty-one (77%) of 53 case-patients, but only 58 (55%) of 106 controls, had eaten food outside the home (odds ratio [OR] = 2.9, 95% confidence interval [CI] = 1.4-6.3). However, case-patients ate at 18 sites outside the home, and no more than five ate at any one location. Case-patients were more likely to have eaten chicken (OR = 4.2, CI = 1.6-10.8) or hamburger (OR = 2.6, CI = 1.1-6.2) outside the home than were controls, but only 31% ate chicken and 40% ate hamburger outside the home. No more than two case-patients ate chicken at any one site, and there were no common suppliers of chicken. Four of the six restaurants in Cabool had the same supplier of hamburger, but only 9 (17%) of the 53 case-patients ate hamburger from one of these restaurants.

Case-patients were not significantly more likely than controls to have shopped at grocery store A (OR = 2.4, CI = 0.86-6.8) or grocery store B (OR = 1.1, CI = 0.5-2.6). They were not more likely than controls to have eaten any particular foods at home, including chicken, hamburger, beef, or milk.

Results of Cohort Studies

Employees of the dairy returned 144 (93%) of 155 questionnaires. Of the respondents, 86% were male and 14% lived within the city limits. Ten (7%) had diarrhea meeting the case definition, and three (2%) had onset of diarrhea between December 25 and January 5. Two persons with bloody diarrhea were identified.

Sixty-four (85%) of 75 employees of the nursing home returned questionnaires. Of the respondents, 95% were female and 36% lived within city limits. Twelve (19%) met the case definition; six (9%) had onset of diarrhea between December 25 and January 5. Three persons with bloody diarrhea were identified.

Nine persons from both cohort studies who met our case definition had onset of diarrhea between December 25 and January 5. Five of these persons had bloody diarrhea. All five persons had eaten hamburger and milk with 2% fat content. Three of the five with bloody diarrhea drank municipal water; the other two worked and ate in the nursing home but did not recall drinking municipal water.

Household Survey Results

We interviewed persons by telephone in 187 (48%) of the 391 households outside the city that had names of household members on the tax roster, thus collecting information on 506 (49%) of the 1036 people living outside the city but within Burdine Township. None of the households used city water. The mean $\pm$ SD distance from households to the city limits was 3 ± 1.5 miles. Ninety-eight (19%) of the 506 persons reported having loose stools since December 15, 1989, of whom 47 (9% of the total) met the case definition (Figure 3). Fourteen (3%) had diarrhea that began between December 25 and January 5, the peak of the outbreak. Three (0.6%) had bloody diarrhea that met the case definition. One (0.2% of total) had bloody diarrhea that began between December 25 and January 5. The 14 case-patients whose onset of

diarrhea was between December 25 and January 5 drank significantly more cups of municipal water per day between December 25 and January 5 than did well persons (1.5 vs 0.3, $p < 0.05$).

We interviewed persons in 236 (41%) of the 577 households inside the city limits who had names of household members on the tax roster, thus collecting information on 556 (27%) of the 2090 people living within the city. Most (99%) of the households used municipal water in the home; two used well water. One hundred nine (20%) of the 556 persons reported having loose stools since December 15, of whom 72 (13%) met the case definition (Figure 4). Forty-three (8%) had diarrhea that began between December 25 and January 5. Twenty-seven (5%) had bloody diarrhea that met the case definition (two other persons with bloody diarrhea did not meet the case definition). Twenty (4% of the total) had bloody diarrhea that began between December 25 and January 5.

Persons living inside the city were more likely to have diarrhea meeting the case definition than were persons living outside the city, although statistical significance was not reached (relative risk [RR] = 1.4, CI = 0.99-2.0) (Table 1). The strength of this association increased and was statistically significant for persons with diarrhea beginning between December 25 and January 5 (RR = 2.8, CI = 1.6-5.1), persons with bloody diarrhea (RR = 8.2, CI = 2.5-26.8), and persons with bloody diarrhea beginning between December 25 and January 5 (RR = 18.2, CI = 2.5-135.1).

To determine whether the association between illness and living inside the city could be explained by other exposures in the city, a subset of surveyed households was questioned about food purchasing and restaurant eating practices between December 25 and January 5. Households inside the city were not more likely than households outside the city to shop at either of the two main grocery stores in Cabool, grocery store A (RR = 1.28, CI = 0.75-2.2), or grocery store B (RR = 1.6, CI = 0.99-2.6). Households inside and outside the city made a similar number of visits to grocery store A (mean 2.7 and 3.2, $p = 0.42$) and grocery store B (mean 3.3 for both). There were no significant differences in the mean number of visits to other stores in Cabool or to stores outside Cabool. There were no statistically significant differences in the likelihood of purchasing hamburger, 2% milk, or chicken from either store. There were no statistically significant differences in the number of persons in households inside the city compared with outside the city that ate at restaurants inside or outside the city.

To determine whether the attack rate was higher in certain areas, the city was divided into 10 sections along lines of the major city streets. The percent of survey households with at least one case of bloody diarrhea ranged from 0% to 33%. Five of the sections had >15% of households with at least one case of bloody diarrhea, and all of these sections are in the northeast part of the city (Figure 5). Seventeen (18%) of 96 households in the northeast part of town had at least one person with bloody diarrhea, compared with five (4%) of 135 households in the rest of the city ($p < 0.05$).

Results of Case Finding and Surveillance

Seven persons who had stayed transiently in the Cabool area reported having diarrhea meeting the case definition within 7 days after their visit. Three

had bloody diarrhea. The dates of exposure ranged from December 12 to January 7; there was no single day that all were in the city. Six of the seven drank unboiled municipal water, and the seventh drank coffee and showered with municipal water. The average length of stay was 3 days, but one person with nonbloody diarrhea reported being in Cabool for only 2 hours; the only item consumed was a single glass of water.

Two cases of bloody and two cases of nonbloody diarrhea were identified in persons living in Texas County who had not visited Cabool in December or January. Stool cultures from one of the persons with bloody diarrhea and one of those with nonbloody diarrhea grew the outbreak strain of E. coli 0157:H7. One, an elderly women, had been exposed several days before her illness to an ill child who goes to school in Cabool. The other person denied any Cabool exposure.

Fifty-eight physicians in the eight surrounding counties, responding to our surveillance questionnaire, reported 22 cases of bloody diarrhea between November 1989 and January 15-23 (when questionnaires were completed). The distribution of physician visits by month was four in November, seven in December, six in January, and five with an unknown date. Persons with possible cases and their physicians were called, and stool specimens were collected from the persons with recent cases. Only one of those cultured grew E. coli 0157:H7, but this isolate's antibiogram was different from the outbreak strain. None of the patients had the clinical characteristics (severe cramping and minimal fever) associated with E. coli 0157:H7 infection.

In November 1988, December 1988, and between January 1 and January 10, 1989, Mid-American Laboratories examined 16, 20, and 7 stools, respectively. None were bloody. One Salmonella strain was the only pathogen isolated. In November 1989 and December 1989, they examined 26 and 30 stools, respectively. None were noted to be bloody and one Salmonella strain was the only pathogen isolated. Between January 1 and January 10, 1990 they examined 15 stool specimens. All 12 from Texas County were bloody and were from residents of or visitors to Cabool. The two hospital-based laboratories in neighboring counties (the only other laboratories performing stool cultures in this region) examined only one bloody stool between December 1, 1989 and January 10, 1990; this was from a Cabool resident. No pathogens were isolated from this stool specimen.

Laboratory Findings

The outbreak strain of E. coli 0157:H7 had a unique antibiotic resistance pattern, with resistance to sulfisoxazole, tetracycline, and streptomycin. Twenty-one isolates of the outbreak strain were cultured from 55 persons submitting stool specimens to the Missouri Department of Health between January 5 and January 20. Forty-nine of these specimens were from residents of or visitors to Cabool, and the remainder were from residents of southern Missouri. Fifty-eight specimens, 12 from visitors to or residents of Cabool and 46 from residents of southern Missouri, were submitted between January 21 and February 9. There were no isolates of the outbreak strain from these specimens. The only other pathogen isolated from a resident of Cabool between December 15 and February 9 was a Salmonella sp. isolated in late January, after the outbreak was over.

Routine bimonthly pairs of water samples from one of the wells and from a single point in the distribution system were collected by the city on December 18 and January 3 with <1 coliform/100 ml found. Between January 6 and 13, 69 water samples were collected by city officials and the Missouri Department of Natural Resources and were cultured in the State Environmental Laboratory. Coliform counts were <1/100 ml for 62 samples, 1/100 ml for six samples, and 2/100 ml for one sample. On January 15, after E. coli 0157 had been isolated from patient's stools, colonies from these samples were examined for E. coli 0157:H7. E. coli 0157:H7 was not isolated. Twelve water samples sent by CDC and the Missouri Department of Health to the State Environmental Lab after January 15 were screened for E. coli 0157:H7. E. coli 0157:H7 was not isolated. No water samples were collected from "dead end" sites (undisturbed areas in the water distribution system) before the water was chlorinated on January 12; however, on February 15, five "dead ends" were found and sampled that did not contain chlorine. Three of the five samples grew >50 coliforms/100 ml when cultured at the EPA, and two of the five samples grew 1-2 coliforms/100 ml at the State Environmental Lab; Enterobacter spp. and Escherichia hermannii predominated. No E. coli 0157:H7 were isolated.

On January 8, a dairy inspector who lived in Cabool on the same street as one of the water main breaks, collected a water sample from a faucet in his basement. The St. Louis City Health Department laboratory reported 22 coliforms/100 ml from that sample, but no screen for E. coli 0157:H7 was performed. Samples collected by city officials on January 11 from the same faucet grew <1 coliform/100 ml at the State Environmental laboratory.

Four ice samples were obtained from Cabool households where ice was made with municipal water between December 25 and January 5. Five samples of ice were obtained from grocery stores between January 5 and January 17. No E. coli 0157:H7 were isolated from these samples.

To examine possible sources of contamination of the city water system (by backflow or cross-connection), stool samples from one dairy cattle herd and two individual cows inside the city, and from two dairy cattle herds located just outside the city limits were cultured. No E. coli 0157:H7 were isolated from 85 cows and one sheep from these sites. The owner of one farm inside the city limits refused testing. Seven wells and ponds on these farms were cultured and no E. coli 0157:H7 were isolated. The dairy processing plant situated inside city limits was cultured extensively, including specimens from all stages of the waste treatment plant; E. coli 0157:H7 was not isolated.

Twenty-seven milk samples, 13 hamburger samples, and five other food samples from the two grocery stores and from patients' homes were cultured at the state laboratory. Twenty-one milk samples, 10 hamburger samples, 17 water samples, seven ice samples, and eight waste treatment samples from the dairy processing plant were cultured at the Food Research Institute. E. coli 0157:H7 was not recovered from any of the specimens.

Environmental Findings

We examined food sources, including hamburger, beef, chicken, milk, and produce in Cabool. Only one brand of milk is sold in the city. The only exposure (other than water) in common between nursing home residents and

persons buying food at either of the two main grocery stores was 2% milk. All milk is packaged at the dairy in Springfield, Missouri, and milk from the same batch is distributed to stores in Cabool and to other towns in a four-state area. In addition, the milk distributed to the nursing home (1/2 pint containers) is packed at a different time than the milk bought at the grocery stores (1/2- and 1-gallon containers). Thus, a single batch of contaminated milk could not have infected persons only in the Cabool area exclusively. The FDA found no production problems in the milk plant.

The city water system has two sources, well #5 and well #6. Well #6 runs continuously, producing about 105 gallons per minute and an average of 145,000 gallons a day. Well #5 can pump 250-275 gallons per minute, and produced 145,000 gallons a day in November and December 1989. When water demand increases, it can produce over 300,000 gallons of water per day. Two water towers in town are connected to the system. A third water tower is situated above well #6 but is disconnected from the city water system. The water main breaks of December 23 and 26 each resulted in a loss of about 200,000 gallons, about 80% of a normal day's usage. To determine whether increased use of well #5 during those breaks would lead to drawing contaminated water (perhaps from a different aquifer), well #6 was shut off for 24 hours, forcing well #5 to run continuously. Coliform counts were not elevated in the post-stress samples from well #5.

No significant cross-connections were found between any dairy farms or the dairy processing plant and the city water system.

The city sewer system has several areas that back up during rainy periods with overflow of sewage into streets and into creeks; however, during December there was very little precipitation. It is unlikely that this rain-associated overflow of sewage could have accounted for cross-contamination of the water system; it is unknown whether sewage leaks persist during dry periods. In addition, the sewage treatment facility, a lagoon system, overflows into a river (passing over a peripheral water main in the southeast portion of town) during wet as well as dry periods.

PENDING STUDIES

- 1) Cluster analysis of the household survey.
- 2) Final data collection to classify nine possible cases.
- 3) The bacterial isolates cultured by the EPA from water at three different points in the distribution system's "dead ends" are being characterized and compared at the CDC. If the bacteria from all sites are the same, they may represent the remnants of a single episode of contamination.
- 4) Location of ill persons' homes will be analyzed in conjunction with a computer model of water flow and distribution being developed by the EPA. It may be possible to localize the site of contamination by determining where water that exposed a majority of cases originated.

DISCUSSION

Many features of this outbreak make municipal water the only likely cause. The high attack rates for persons of all ages living throughout the city is characteristic of a waterborne outbreak. The epidemic curve revealed a marked decrease in cases after the order to boil water and chlorination of the water. The outbreak was confined to persons who could have been exposed to municipal water, and did not extend into the surrounding county. The only common exposure between nursing home cases (and older case-patients in retirement housing) and the cases in the community was water (the milk served to nursing home residents was packed at different times than the milk bought at the grocery stores). In the case-control study, case-patients drank significantly more city water than did controls. No food or restaurant was significantly associated with illness. In the household survey, bloody diarrhea was strongly associated with living inside the city ($RR = 18.2$), and no other city-associated exposures were associated with illness. Among persons surveyed who lived outside the city, case-patients with onset of illness during the peak of the outbreak drank significantly more municipal water than did well persons. The municipal water distribution system was affected by extremely cold weather: over 40 water meter replacements and two water main breaks occurred several days before the peaks in the epidemic curve. Although E. coli 0157:H7 was not isolated from water samples, no samples were collected between December 23 and January 2, the likely exposure period for most cases (assuming a 3-4 day incubation period). Cultures of several undisturbed areas of water grew >50 coliforms per 100 ml, possible evidence of prior contamination.

Although food eaten outside the home, in particular chicken and hamburger, was associated with illness in the case-control study, this is unlikely to be causal. No more than 40% of case-patients ate either chicken or hamburger outside the home, and they ate them at many different places. Chicken and hamburger eaten at home were not associated with illness. The observed association may be an artifact of the study design: potential controls who ate outside the home may not have been home when called by the interviewers, so controls that were reached may have been more likely to eat at home than case-patients.

Results of our survey indicate that our case-finding methods were comprehensive. Twenty-one (78%) of the 27 cases of bloody diarrhea in city residents randomly detected by the survey were already known to us through other case-finding methods.

Similar to prior outbreaks, the attack rates were highest at the extremes of age and the proportion of case-patients with bloody diarrhea increased with age. The proportion of those with nonbloody diarrhea (65%) was higher than in prior studies. This suggests that laboratories that do not routinely culture for E. coli 0157:H7, or do so only with bloody diarrhea, may be underreporting E. coli 0157:H7 infection.

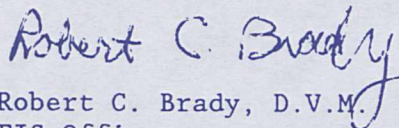
This was the largest reported outbreak of illness caused by E. coli 0157:H7, and the first linked to waterborne transmission. The outbreak strain is the most antimicrobial-resistant E. coli 0157:H7 isolate yet reported from the

United States. This outbreak emphasizes the importance of routine screening of stools for E. coli O157:H7, and suggests that nonbloody diarrhea may be the most common manifestation of infection with this organism.

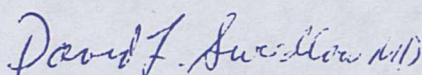
RECOMMENDATIONS

We made the following recommendations:

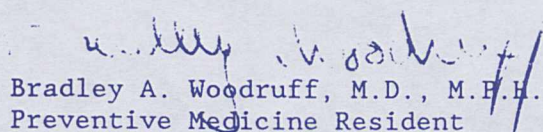
- 1) Permanent chlorination of the municipal water system of Cabool;
- 2) Flushing and hyperchlorination of the system as a routine measure whenever water main breaks occur and are repaired;
- 3) Relief of sewer line obstructions and an increase in the capacity of the lagoon treatment sites;
- 4) Continued surveillance for bloody diarrhea in southern Missouri;
- 5) Follow-up of forthcoming EPA recommendations.



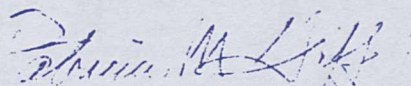
Robert C. Brady, D.V.M.
EIS Officer
Division of Field Services
Epidemiology Program Office



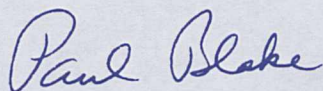
David L. Swerdlow, M.D.
EIS Officer
Enteric Diseases Branch
Division of Bacterial Diseases
Center for Infectious Diseases



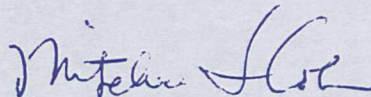
Bradley A. Woodruff, M.D., M.P.H.
Preventive Medicine Resident
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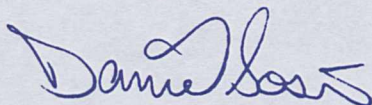
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Daniel M. Sosin, M.D.
Division of Field Services
Epidemiology Program Office

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Diarrheal illness in city residents, by date of onset and character of stool, Cabool, Missouri 12/89-1/90

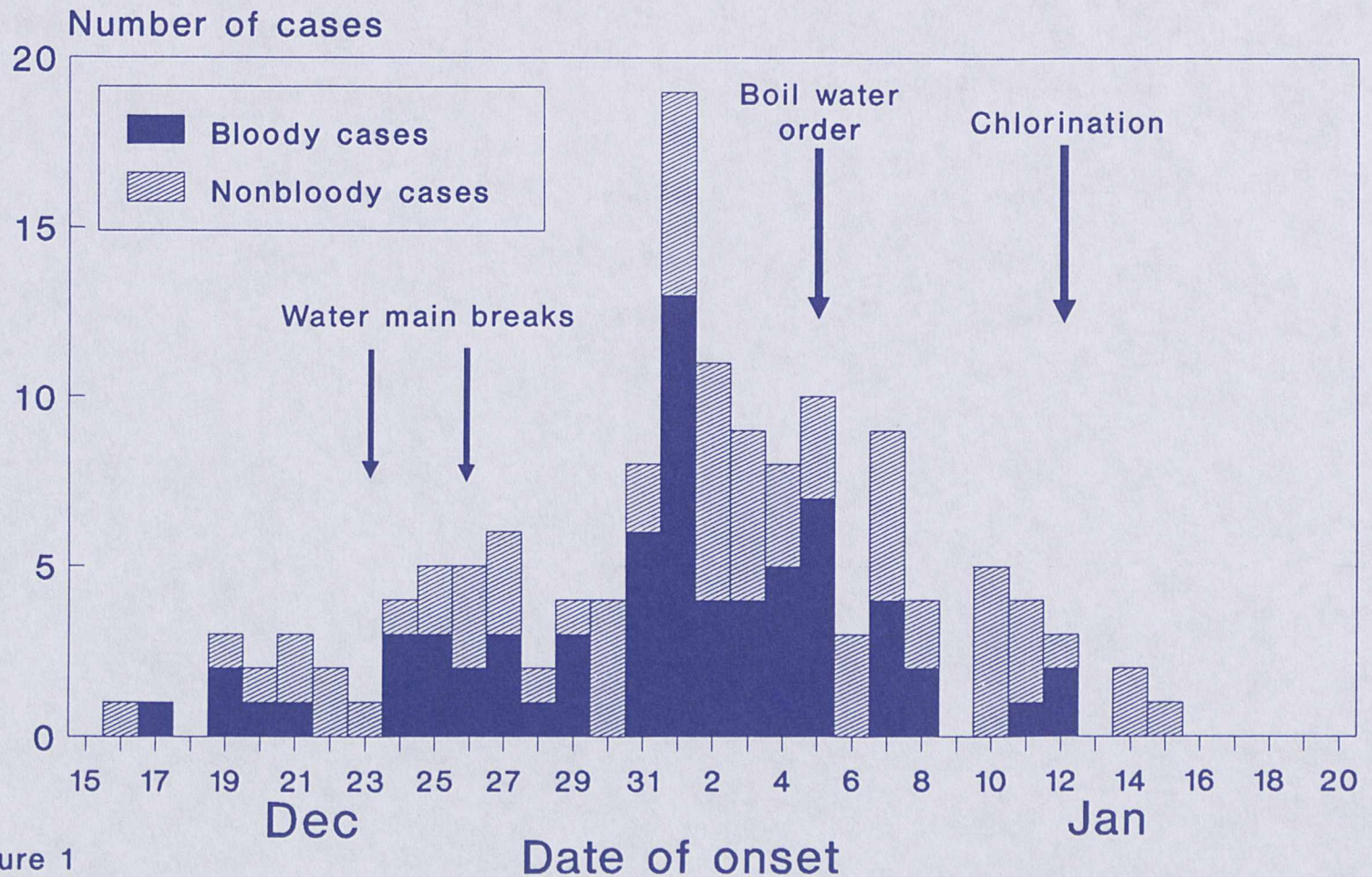


Figure 1

Diarrheal illness in non-city residents, by date of onset and character of stool, Cabool, Missouri 12/89-1/90

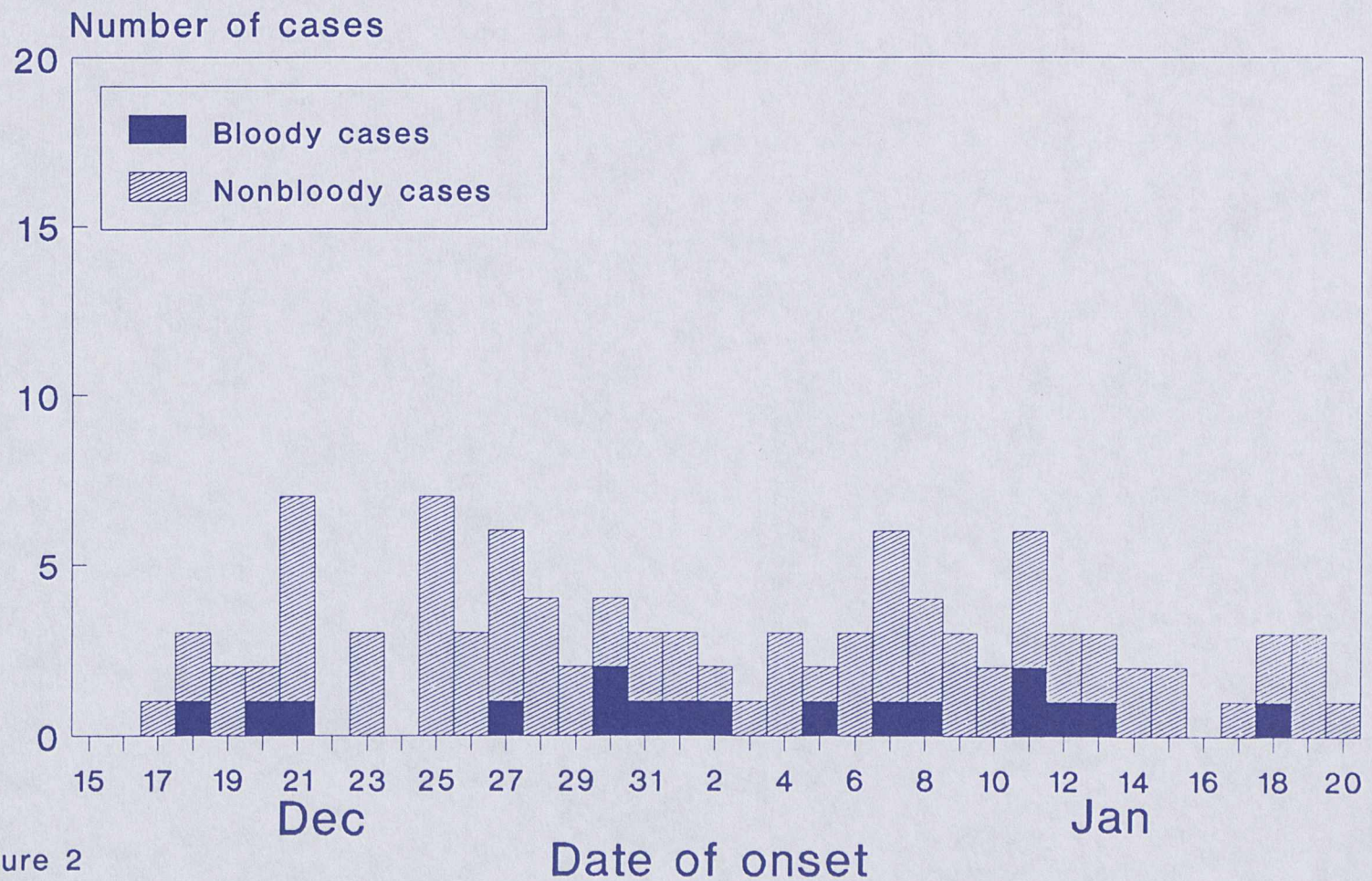


Figure 2

Diarrheal illness, by date of onset and case definition

Burdine Township survey, 12/89-1/90

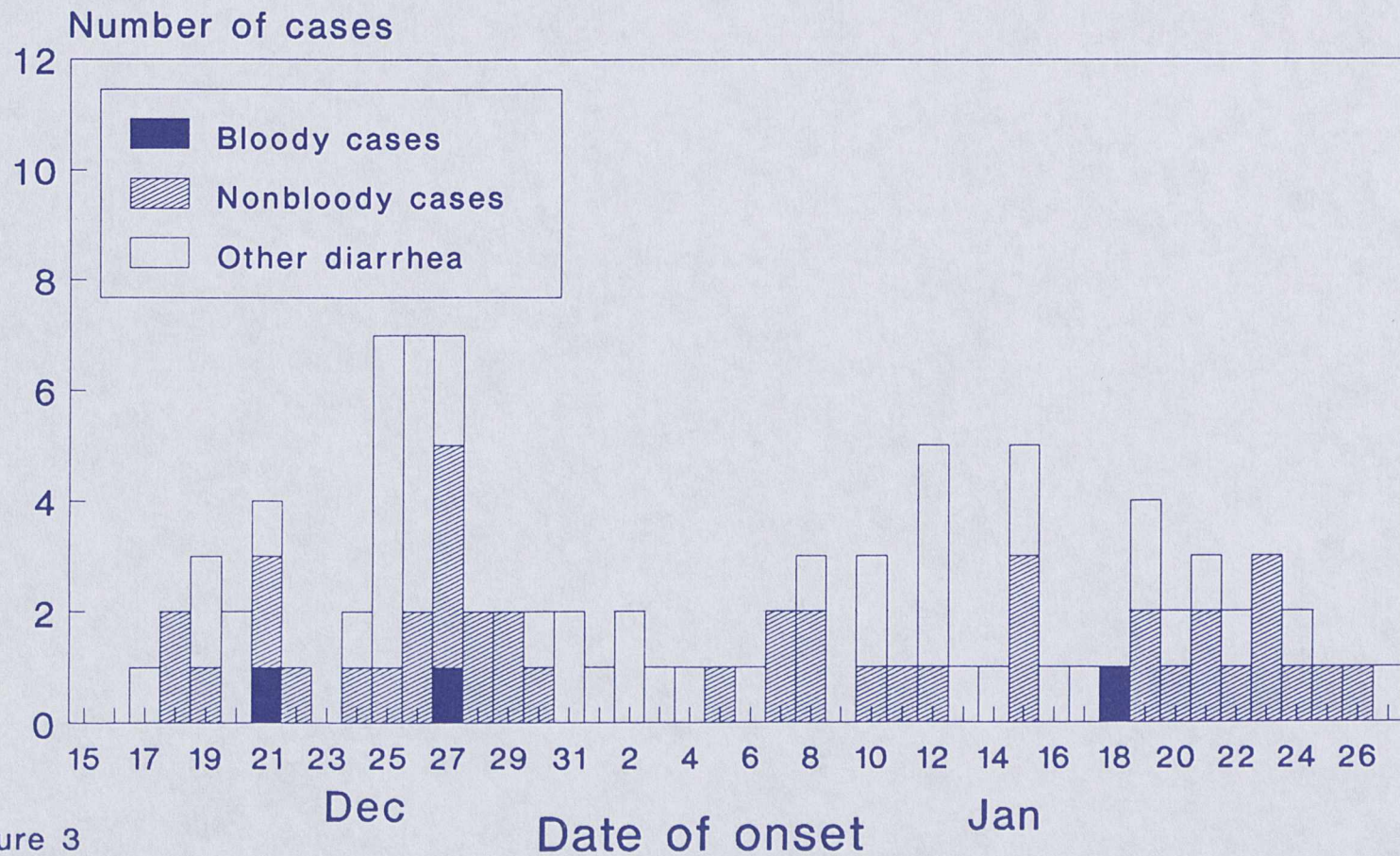


Figure 3

Diarrheal illness, by date of onset and case definition Cabool in-town survey

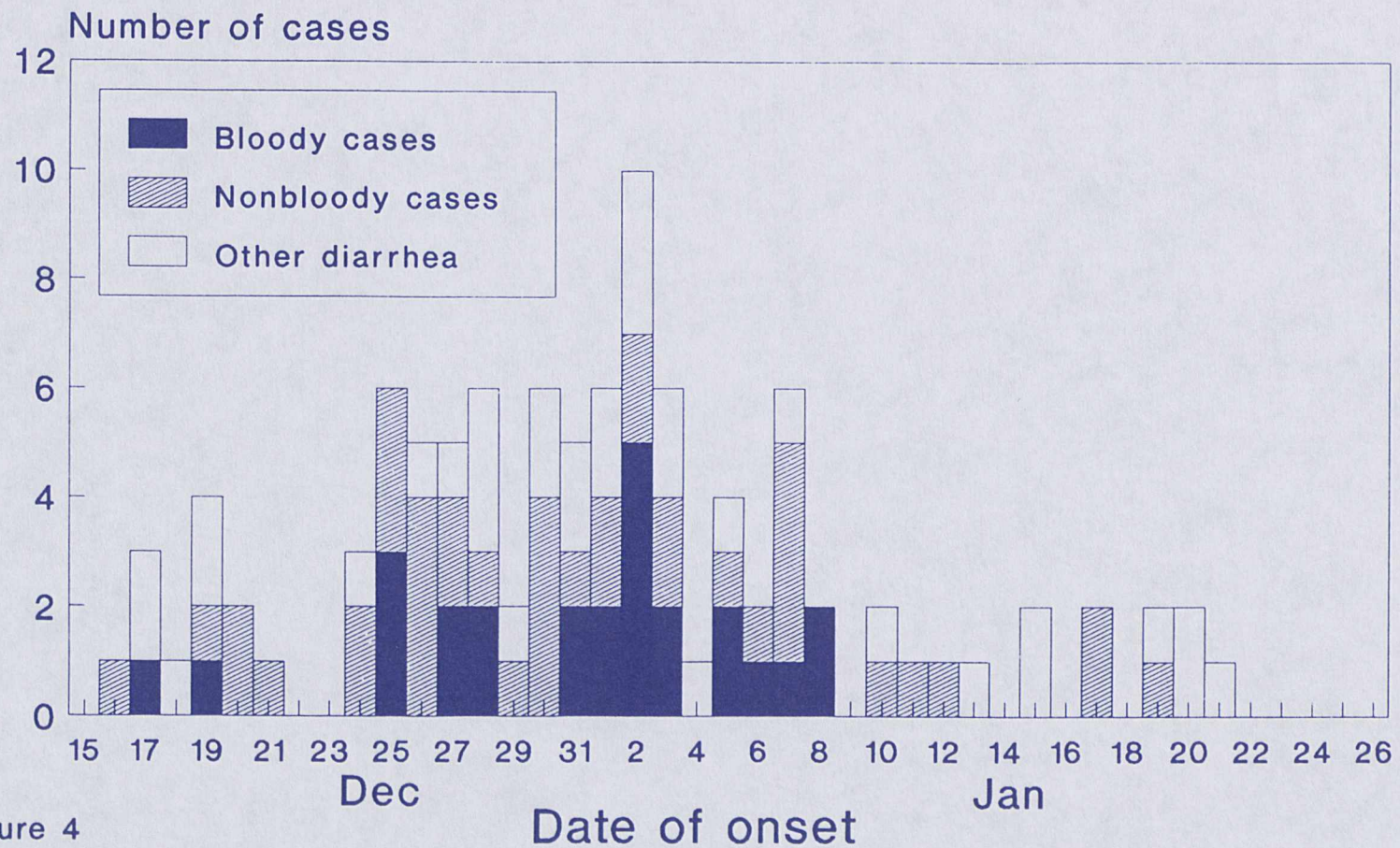


Figure 4

HOUSEHOLD SURVEY

PERCENT OF HOUSEHOLDS WITH BLOODY DIARRHEA

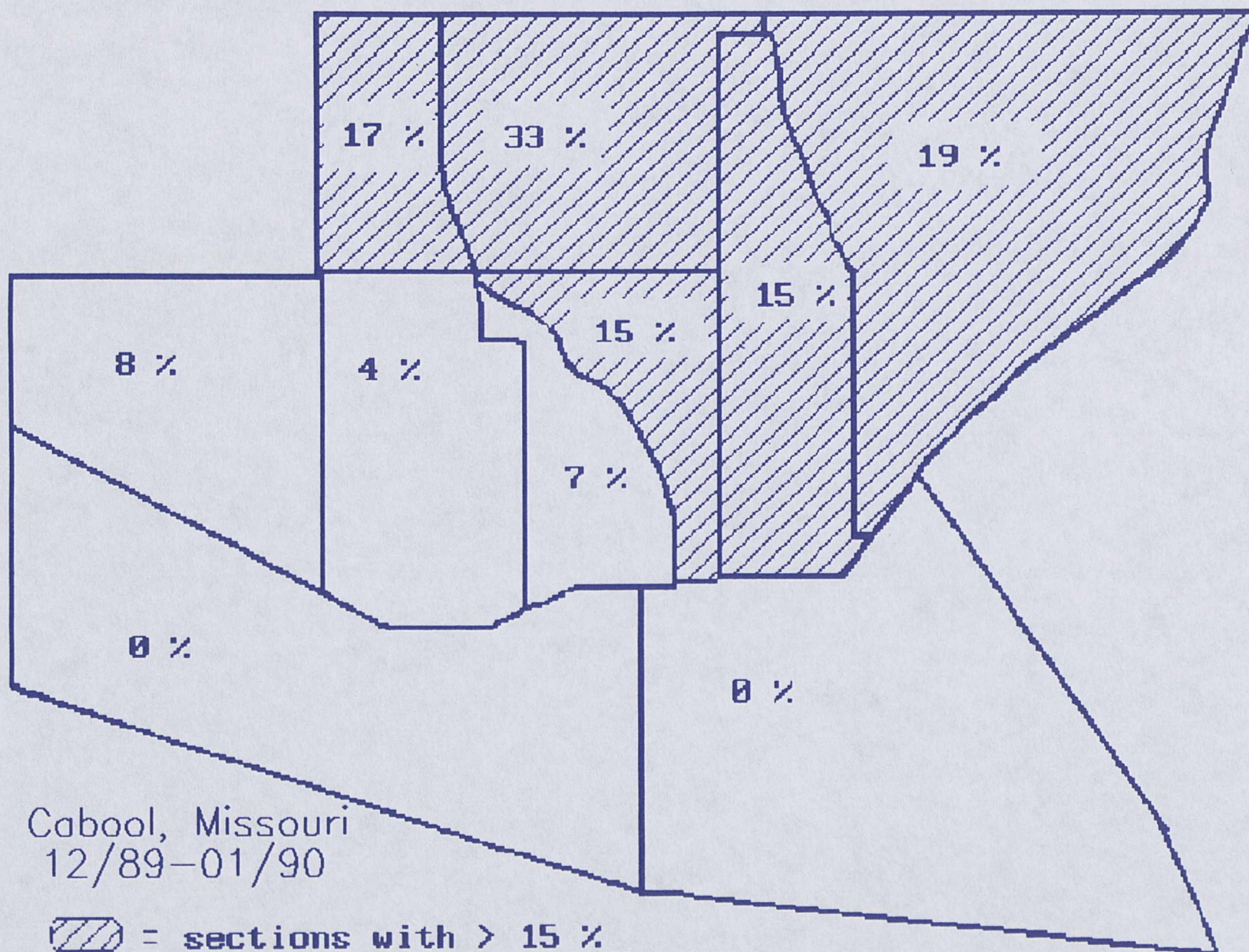


Figure 5

Table 1.

Results of telephone survey of households inside and outside city limits,
Cabool, Missouri.

Definition	Inside city (n=556)	Outside city (n=506)	RR	95% CI
Total diarrhea	109 (19.6%)	98 (19.4%)	1.0	0.8-1.3
All cases	72 (12.9%)	47 (9.3%)	1.4	0.99-2.0
Cases onset 12/25- 01/05	43 (7.7%)	14 (2.8%)	2.8	1.6-5.1
All bloody cases	27 (4.9%)	3 (0.6%)	8.2	2.5-26.8
Bloody cases onset 12/25-01/5	20 (3.6%)	1 (0.2%)	18.2	2.5-135.1



EPI-AID: EPI-90-00-3
DATE: January 00, 1990
TO: Director, Centers for Disease Control
FROM: EIS Officer, CIO/Division/Branch/Section
SUBJECT: Title of Outbreak
LOCATION: City, State

SUMMARY

The results of this investigation are reported in the attached (journal or MMWR) article.

Signature
Title
Division, CIO

Attachment

Distribution: Mailing Keys WF-1,-2,-3; ZW

Note: List names and mailing addresses of appropriate field contacts that are to receive copies of the report. IT IS THE RESPONSIBILITY OF THE INITIATING OFFICE TO MAIL COPIES TO PERSONS NOT INCLUDED ON THE MAILING KEYS.



Centers for Disease Control



EPI-AID : FER 89-11

DATE : June 4, 1990

TO : Director, Centers for Disease Control

FROM : Jean-Claude Desenclos, M.D., EIS Officer, Division of Field Services

SUBJECT : An Outbreak of Diarrhea in an Extended Care Unit, Florida, 1989

LOCATION : Florida

DATE OF DEPARTURE: N/A

DATE OF RETURN : N/A

SUMMARY

During January 1989, an outbreak of diarrhea (defined as ≥ 3 loose stools/day for at least 1 day) occurred among the patients and the employees of the Extended Care Unit (ECU) at a hospital in Tallahassee, Florida. Fourteen (attack rate [AR] 38.9%) of the 36 ECU patients and 10 (AR 19.2%) of the 52 employees were identified as cases. Cases occurred from January 5 to 24. The illness was characterized by watery diarrhea, low-grade fever, abdominal cramps, and headache. The maximum number of loose stools per day ranged from 3 to 10, median = 5. Stool specimens of acutely ill patients tested negative for bacterial pathogens and for rotavirus. Paired sera on 10 patients did not show an increase of Norwalk antibody titer. Temporal clustering by room suggested person-to-person transmission. To test the hypothesis of transmission of illness from patient to patient through health-care worker contacts, we compared attack rates of diarrhea for patients by amount of contact with health-care workers. Patients classified as receiving a higher level of nursing and medical care, involving more frequent contacts with health-care workers, were five times more likely to develop diarrhea than the other patients (relative risk [RR] 5; 95% confidence interval (CI) 0.8,33.4; $p = 0.05$). Similarly, health-care workers who reported contact with symptomatic

patients were more likely to become cases (25%) than the other workers (8%), RR 2.5; 95% CI 0.6,10.6; $p = 0.3$. These data suggest that the infection was transmitted from patient to patient by contact with health-care workers.

INTRODUCTION

On January 17, 1989, the Acting Infection Control Nurse, at a hospital in Tallahassee, Florida, called Jean-Claude Desenclos, M.D., EIS Officer, Division of Field Services (DFS), Epidemiology Program Office (EPO), assigned to the Florida Department of Health and Rehabilitative Services (FDHRS) to discuss a high rate of diarrhea for patients of the Extended Care Unit (ECU) of the hospital. Ten (28%) of the 36 patients had had diarrhea during the previous 12 days while hospitalized. This incidence of diarrhea contrasted with the usually noted chronic constipation among the patients of the unit. Stool specimens taken for bacterial culture from five diarrhea patients did not yield any pathogens. Two health-care workers were reported to have diarrhea with onset on January 16. Further discussions were held with Karl Klontz, M.D., M.P.H., Medical Executive Director, Epidemiology Program, FDHRS; Michael H. Wilder, State Epidemiologist, FDHRS; and Robert A. Gunn, M.D., Deputy Director, DFS, EPO, CDC. As a result it was decided to assist the hospital in the investigation of the outbreak.

BACKGROUND

The ECU is located on the first floor of a 2-story facility, located near the main building of the hospital. This unit is composed of two areas (A and B) on either side of the entrance (Figure 1). There are 25 double and six single rooms in the ECU. At the time of the outbreak, 36 patients were hospitalized in the ECU; 12 of the 25 double rooms had two patients in them. A Long-Term Care Unit (LTCU) for chronically ill, elderly patients is located on the second floor of the facility.

Patients in the ECU are mostly elderly patients (median 75; range 30 to 94 years) who were recently discharged from acute-care units where they had been treated for a serious acute condition. They may stay in the ECU a few days to months; most are waiting to be transferred either to a nursing home or to the LTCU on the second floor. Most of the patients of the ECU have several underlying conditions, are mentally debilitated, and are not ambulatory. Inability to ambulate and dependency on medical care are two major factors that make these patients heavily dependent upon health-care workers for their basic needs (personal hygiene, feeding, moving etc.).

The food served to the patients comes mostly from the main kitchen of the hospital. However, breakfast is prepared at the ECU kitchen; this includes cooking of scrambled eggs, toast, and coffee. In addition, some food items such as lettuce salad are handled at the ECU kitchen. The same food items are served in the ECU and the LTCU, in the patient rooms or in a dining room (one in the ECU and one in the LTCU) for those able to walk.

About one-third of the ECU patients are tube-fed with a high-calorie, liquid food. The water supply system to the ECU is the same as for the other building of the hospital.

There are 55 employees working in the ECU facility including nurses, nursing technicians, physical therapists, and dietary, maintenance, office, and housekeeping personnel. The health-care workers (nurses, nursing technicians, physical therapists etc.) work in three shifts (7 a.m.-3 pm, 3 p.m.-11 p.m. and 11 p.m.-7 a.m.). Workers on the morning shift are assigned to the care of specific rooms, but not those on the two later shifts (composed mainly of nurses and nursing technicians).

In January 1989, there was an increase in the number of patients (mostly children) with watery diarrhea and mild fever reported from physicians in the Tallahassee community. There was a 100% increase in the number of cases of diarrhea seen at the emergency room of the hospital the second and third weeks of January compared to the prior 2 weeks.

MATERIAL AND METHODS

Epidemiologic Investigation

A case of outbreak-related diarrhea was defined as ≥ 3 loose stools per day for at least 1 day in January 1989 in any person in contact with the ECU building, first or second floor, (patient, worker, or visitor). Retrospective and prospective surveillance for diarrhea cases were initiated by the nursing staff among both the ECU and the LTCU patients and health-care workers. Visitors were informed of the outbreak through posters in the ECU and were requested to report any episodes of diarrhea to the nursing staff.

Patients - To identify risk factors, a cohort study was initiated on ECU patients in January 1989. The medical and nursing charts of patients hospitalized in the ECU during January were reviewed to collect data on age, sex, room number, underlying and current medical conditions, ambulatory and mental status, feeding habits, treatments and nursing care, and, if ill, symptoms and date of onset. Patients in the ECU were then classified into three categories according to the amount of contact with health-care workers: 1) basic nursing and medical care, 2) patients that needed extra nursing care (e.g. assistance to sit on a chair or wheel chair; personal hygiene); and 3) patients that needed a higher level of nursing and medical care (skin care, mouth care, feeding, tube feeding, infusion, injections, physical therapy, oxygen therapy). A score for hand contact was later developed for those in the category No. 3. Each of the following activities involving hand contact of health-care workers with patients was rated a score of 1: assisting in personal hygiene, moving to a chair and to the bed, moving inside the bed, assisting in walking, feeding, tube-feeding, skin care, mouth care, eye care, physical therapy, oxygen therapy, respiratory therapy, urinary catheter, any medical procedure (infusion etc.).

Employees - A questionnaire was distributed to the ECU staff. The employees were asked about symptoms during January 1-25 and whether they had had contacts with patients with diarrhea.

Statistical Analysis - An analysis of geographic clustering of cases using the binomial distribution was done (1). The number of double occupancy rooms in the ECU in which zero, one, or two persons would be expected to be ill, given a random distribution of illness, were compared to the observed number by the Kolmogorov-Smirnov test.

To assess the risk of illness after exposure to an ill roommate to the general risk among roommates during the outbreak period, an incidence density approach was used. A person contributed observation time from the beginning of the outbreak until they became ill, or until the end of the outbreak if they did not become ill. We studied only persons in double-occupancy rooms and divided observation time into two periods. The high-risk period was those person-days of observation which occurred 1-3 days after the onset of illness of a source case in a room. The general or low-risk person-days (background) were all other days during the 20 days of the outbreak (January 5-24, 1989). Cases per 100 person-days were calculated for each period, and the resulting rates were divided to provide an estimate of relative risk. All persons in the outbreak were considered susceptible to illness. To evaluate the effect of the duration of the outbreak period on the incidence density rates for high-risk and low-risk periods, we computed incidence density rates for a longer (+ 14 days) and a shorter (- 14 days) outbreak period.

Relative risk (RR) was also calculated for various characteristics using a cumulative incidence approach. Statistical significance was tested, using the Chi-square test with the Yates correction or the Fisher exact test as appropriate, and the 95% Greenland confidence interval.

Laboratory Investigation

Stool specimens were collected from 12 patients and were cultured on MacConkey agar, Salmonella-Shigella agar, and thiosulfate citrate bile salts sucrose agar and for Campylobacter. One of these specimens was tested for Clostridium difficile toxin by enzyme immune assay. No attempt was made to isolate toxigenic Escherichia coli. Other stool specimens were collected from 10 of the patients still symptomatic and five non-ill patients on January 19 and were tested for rotavirus using the Abbott enzyme immune assay, and by electron microscopy at the Viral Gastroenteritis Unit, Division of Viral Diseases, Center for Infectious Diseases, CDC. Acute-ill and convalescent-phase sera (within 2 weeks) were obtained from the 10 patients and processed at the Viral Gastroenteritis Unit, CDC, for enteric virus serology. Those 15 stool specimens were further tested for Clostridium difficile cytotoxin at the Anaerobe Reference Laboratory, Anaerobic Bacteria Branch, Hospital Infections Program, CID, CDC.

Environmental Investigation

The kitchen of the ECU was inspected, and the food handling procedures were reviewed by the infection control nurse. Hand-washing procedures and enteric precautions of the employees were reviewed by both the infection control nurse and the ECU nursing director. Water distributed by the ECU was not tested for chlorine level or coliform.

RESULTS

Epidemiologic Investigation

Patients - A total of 14 case-patients was identified among the 36 ECU patients (AR 38.9%). The number of stools per day among ill patients ranged from 3 to 10 (median 5). Two (14%) case-patients required intravenous fluid therapy. Stools were watery for most of the case-patients. None of the case-patients had bloody stools. The prevalence of other symptoms is shown in Table 1. Most (79%) of the patients with diarrhea had fever (>100 F) concurrently or within 12 hours prior to onset. Diarrhea among patients, lasted from 2 to 10 days, median 4 days.

Cases occurred from January 5 to January 24 (Figure 2). One visitor was reported ill on January 20. ECU case-patients by room and date of onset are shown in Figure 1. Eight occurred in zone A (AR 34.8%) and six in zone B (AR 46.1%); the first seven cases were in the same area of zone A (Figure 1). There were no cases among the LTCU patients on the second floor. Analysis of geographic clustering using the binomial distribution did not show a statistically significant difference between expected and observed number of double-occupancy rooms with none, one, and two cases, respectively, $p = 0.2$ (Table 2).

In the double occupancy rooms there was a total of 379 person-days of observation during the outbreak period (January 5-24). There were 7/12 double rooms with a source case and 16 high-risk days (1-3 days after a roommate became ill). Three cases occurred during the high-risk period for a rate of 18.8 cases per 100 person-days. Seven cases occurred during the 363 person-days of low-risk (background) for a rate of 1.9 cases per 100 person-days. Thus, the relative risk (RR) of having onset of illness 1-3 days after illness in a roommate was 9.7 (95% confidence interval [CI], 2.8,34.2, $p = 0.006$). With an outbreak period of 14 more days, the number of high risk days would be 18 instead of 16, and there would still be three cases with onset in the high risk period (incidence density rate = 16.7%). On the other hand, seven cases would occur during 557 (363 + 194) low-risk days (incidence density rate = 1.3%). Thus the $RR = 13.3$, 95% CI 3.7,47.2, $p = 0.003$. When the outbreak period is reduced by 14 days, the incidence density rate for the high-risk period becomes $1/4 = 25.0\%$ per 100 person-days as compared to $2/134 = 1.5$ per 100 person-days for the low-risk period, $RR = 16.8$, 95% CI 1.9,14.8, $p = 0.09$.

Attack rates by patient characteristics, host factors, treatments, and feeding practices are given in Table 3. Attack rates were similar by age and gender. Those who were tube-fed were 2.1 times more likely to develop diarrhea than those who were not ($p = 0.1$). Attack rates by category of amount of contact with health-care workers are shown in Table 4: those with the most contact (category No. 3) had a risk of illness 5 times greater than those with less contact (category Nos. 1 and 2) ($RR = 5.0$, 95% CI 0.8,33.4; $p = 0.05$). Attack rates of diarrhea for those tube-fed and those not tube-fed in category No. 3 were 57% (8/14) and 42% (5/12), respectively ($RR = 1.4$; 95% CI 0.6,3.1; $p = 0.7$). For patients with the highest contact (category No. 3), the attack rate increased as the hand contact score increased (Table 5, Chi-square for trend, $p = 0.14$).

Employees - Fifty-two (95%) of 55 employees assigned to the ECU returned the questionnaire. Ten of the 52 employees developed diarrhea (AR 19.2%) from early January to January 24 (Figure 2). Diarrhea was watery among case-employees; case-employees were more likely to report headache, abdominal cramps, and nausea than case-patients (Table 1). Duration of illness was ≤ 2 days among employees. Two of the employee cases occurred very early in the outbreak (Figure 2); one with onset on January 6 and the other between January 2 to 6 (not shown on Figure 2). The employee with onset between January 2 to 6 could not remember the exact day of onset; he became ill after returning from holidays. He worked in the kitchen as a supervisor, but did not handle any food.

Employee case-patients ranged in age from 23 to 56 years, median 39 years. Attack rates were calculated by position and shift; nursing employees (nurses and nursing technicians) had a rate of illness of 29.6% (8/27) compared to 8% for other employees (2/25), RR 3.7; 95% CI 0.9,15.8; $p = 0.08$. Those working in the afternoon shift (3 to 11 p.m.; mostly nursing staff with contact with patients) had a risk of diarrhea of 40% compared to 11% for those working the two other shifts (RR 3.7, 95% CI 1.2,11.3; $p = 0.02$). Eight (25%) of 32 employees who had professional contacts with case-patients developed diarrhea 1 to 5 days after exposure compared to two (10%) of the 20 workers who did not report such contacts (RR 2.5; 95% CI 0.6,10.6; $p = 0.3$). Among employees who had professional contact with case-patients, those who reported to have been in contact with more than four case-patients before onset, had an attack rate of diarrhea of 37.5% (6/16) compared to an AR of 12.5% for those who had been in contact with ≤ 3 case-patients (2/16), RR 3; 95% CI 0.7,12.7, $p = 0.2$).

During the outbreak, three (5.7%) employees reported a diarrhea illness in one household member; however, no date of onset was available for these household cases. Two (20%) were in household members of employees with diarrhea compared to one (2.4%) in the household of the well employees (RR 8.4; 95% CI 0.8,83.7; $p = 0.09$). These three employees were among those who had professional contact with case-patients (AR 9.4% [3/32] compared 0% [0/20] for those without any professional contacts with case-patients [RR indefinite, $p = 0.3$]).

Laboratory Results

The stool specimens from case-patients were negative for bacterial pathogens and for rotavirus. The one case-patient initially tested for C. difficile toxin was positive. The virologic investigation was limited to the Norwalk serology on paired sera only, and failed to detect any increase of Norwalk antibody titer. The search for C. difficile cytotoxin at CDC was positive for the one case previously identified and none of the non-ill patients.

Environmental Investigation

None of the employees who handled or served any food during the outbreak had developed symptoms. No particular problem was noticed with the preparation, storage, and the distribution of the food prepared at the ECU.

Review of hand-washing procedures indicated that, although it is required between giving care to two successive patients, this measure was not fully observed. No gloves were used on a routine basis for nursing purposes.

DISCUSSION

The organism responsible for this outbreak was probably a virus. No bacterial pathogens were identified. The watery diarrhea and the associated symptoms (fever and headache) were compatible with a viral etiology. Toxigenic E. coli was not looked for in the acute-phase stool specimens, but this agent is unlikely to have contributed to this outbreak: outbreaks associated with E. coli in the United States have been rare, usually produce an illness of >5 days, and are not associated with secondary transmission (2-3). C. difficile toxin was isolated from the only patient tested. C. difficile is also transmitted from person to person by health-care workers hands and infection may be acquired without symptoms (4). However, the clinical picture of diarrheal patients (none had bloody stools) is not consistent with that organism. In addition, antibiotic treatment was not a risk factor for the occurrence of illness (Table 3). Rotavirus was not detected in stool samples of acutely ill case-patients and was probably not involved in this outbreak. Although Norwalk agent was not implicated by the serology on paired sera, a Norwalk-like agent that could not be identified by the microbiologic techniques used in this investigation still remains as a plausible etiology.

As a teaching digression, we used this outbreak as an opportunity to study the effect of the duration of observation (outbreak period) on the incidence density rates and the measure of association. When the duration of the outbreak is prolonged and no cases occur (presumably non-exposed period), the denominator of the low-risk or background period is inflated by no risk days and the incidence density of the low-risk period is reduced without affecting the high-risk period; thus, the RR is greater. On the other hand, shortening the outbreak period reduces both the numerator (cases) and the denominator (days of observation) and alters the power of the study. Thus any change in incidence density reflects "chance" variation as shown by a higher RR, but a p value = 0.09 in our example.

In this outbreak we did not calculate incidence density rates in an unmatched way (e.g. without reference to room geography) for high and low exposure period because most of the patients were not ambulatory and had low or no contact with other patients. Therefore, the only patients exposed to a case were roommates.

Our data strongly suggest that person-to-person transmission occurred in this outbreak and possibly through hand contact with health-care workers. The dates of onset and the temporal clustering are consistent with person-to-person transmission. The first cases occurred in the same area of zone A of the ECU and subsequently spread to zone B. No cases occurred in the LCTU where patients received the same food as those of the ECU, a finding that suggests food-borne transmission was very unlikely. The major risk factor identified for the occurrence of illness among patients was a greater amount of contact with health-care workers and, among health-care workers, contact with a diarrhea patient. Furthermore, among patients who needed a greater

level of nursing and medical care, the rate of diarrhea increased with the score of hand contact with health-care workers. Health-care workers who had professional contact with ≥ 3 ill patients were also more likely to become ill. These findings suggest that the causative organism may have been transmitted from patient-to-patient through health-care workers' hand contacts. Health-care workers may have been infected by contact with patients. Ill and asymptomatic infected employees may have also played an important role in transmitting the illness to some patients through professional contact.

The overall increased risk documented for tube-fed patients (RR 2.1) was probably related to the fact that these patients needed more care and, therefore, more contact with health-care workers. This is suggested by the lower relative risk of illness (RR 1.4) for tube-feeding among those with high contact (category No. 3).

One employee became ill just before, or at the beginning of the outbreak after returning to work from Christmas holidays. This employee worked in the kitchen as a supervisor, but reported that he did not handle any food. It is possible, however, that he introduced the virus in the facility.

RECOMMENDATIONS

Based on the findings and their discussion with the hospital infection control committee, the following recommendations were made:

1. Employees with diarrhea should not work until free of diarrhea for at least 1 day.
2. New patients should not be admitted to the unit until the unit has been free of diarrhea cases for a period of 1 week.
3. Case-patients should not be discharged to nursing homes or to the LTCU until 1 week after the end of diarrhea.
4. Health-care workers from the ECU should not have any contact with the patients in the LTCU.
6. Health-care workers should wash their hands with water and soap after taking care of a patient.
7. Children should not be admitted as visitors during an outbreak.
8. Adult visitors should be told to wash their hands with soap before leaving their relative.
9. Maintain surveillance of diarrhea in the ECU and the LTCU.

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4. McFarland LV, Mulligan ME, Richard YY, Kwok MS, Stamm WE. Nosocomial acquisition of Clostridium difficile infection. *N Engl J Med* 1989;320:204-210.

TABLE 1. Prevalence of symptoms among 14 case-patients and 10 case-employees, Tallahassee, Florida, January 1989.

<u>Symptoms</u>	<u>Patients</u>		<u>Employees</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
Diarrhea	14	100	10	100
Fever (>100)	11	79	*	*
Abdominal cramps	4	28	7	70
Nausea	2	14	5	50
Vomiting	2	14	2	20
Headache	NA**	NA**	6	60

* Temperature not measured, but four reported to have had some fever

** Not available

TABLE 2. Analysis of geographic clustering of cases of diarrhea in double occupancy rooms, Tallahassee, Florida, January 1989.

Health Status in Double Occupancy rooms	Number of Double Occupancy Rooms	
	Observed	Expected*
0 case	5	4.1
1 case, 1 well	4	5.8
2 cases	<u>3</u>	<u>2.1</u>
Total	12	12.0

Kolmogorov-Smirnov test: $p = 0.20$

*Expected numbers calculated by binomial distribution given a random distribution of cases.

Expected number of rooms with x case-persons: $(N) \frac{n!}{x!(n-x)!} p^x q^{n-x}$

where N = number of double occupancy room (i.e. number of trials; $N = 12$)
 x = number of case-persons in the room (i.e. the number of positive observations in a given trial)

n = number of persons in rooms (i.e. the number of observations in a trial; $n = 2$)

p = attack rate in double occupancy room (i.e. the probability of a positive observation) = $10/24 = 0.42$ and

$q = 1-p = 0.58$.

For 0 ($x=0$) case-persons the expected number = $12 \frac{2!}{0! 2!} 0.42^0 0.58^2 = 4.1$

TABLE 3. Attack rates (%) by patient characteristics, treatments, and feeding practices, Tallahassee, Florida, January 1989.

Factor	Present			Absent			RR	95% CI	P value
	Total	Case	AR	Total	Case	AR			
Patient Characteristics									
Age >75	13	6	46	23	8	35	1.3	0.6,3.0	0.8
Male gender	16	4	25	20	8	40	0.9	0.4,2.1	0.8
Diabetes	10	4	40	26	10	38	1.0	0.4,2.6	1.0
Senile	24	11	46	12	3	25	1.8	0.6,5.3	0.3
Treatment									
Antibiotic	17	7	41	19	7	37	1.1	0.5,2.5	0.9
Antacid	9	4	44	27	10	37	1.2	0.5,2.9	0.7
Corticosteroid	4	0	0	32	14	44	0.0	?	0.1
Feeding practices									
Ate in dining room	14	3	21	22	11	50	0.4	0.1,1.3	0.2
Tube fed	14	8	57	22	6	27	2.1	0.9,7.8	0.1

TABLE 4. Attack rate of diarrhea by patients' contacts with health-care workers, Tallahassee, January 1989.

Contact Category	No. in Category	Case	AR (%)
1	4	0	0
2	6	1	17
3	26	13	50
Total	36	14	

TABLE 5. Attack rate of diarrhea for contact category No. 3, patients by score of health-care worker hand contact, Tallahassee, Florida, January 1989.

Score of Hand Contact	Number in Group	Case	AR (%)
<8	5	1	20.0
8-9	15	8	53.3
>9	6	4	66.7

Figure 1. Diarrhea cases by room and date of onset, extended care unit, Tallahassee, Florida, January 1989.

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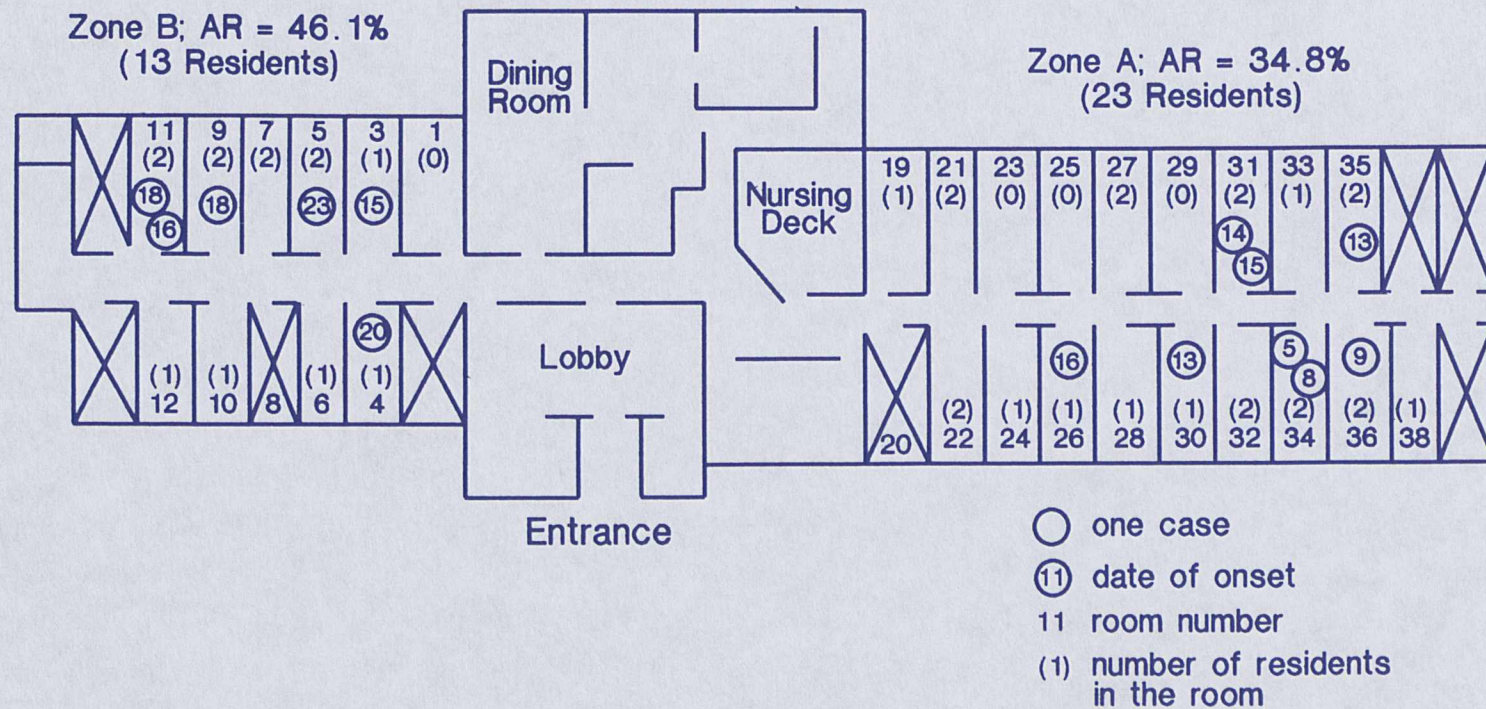
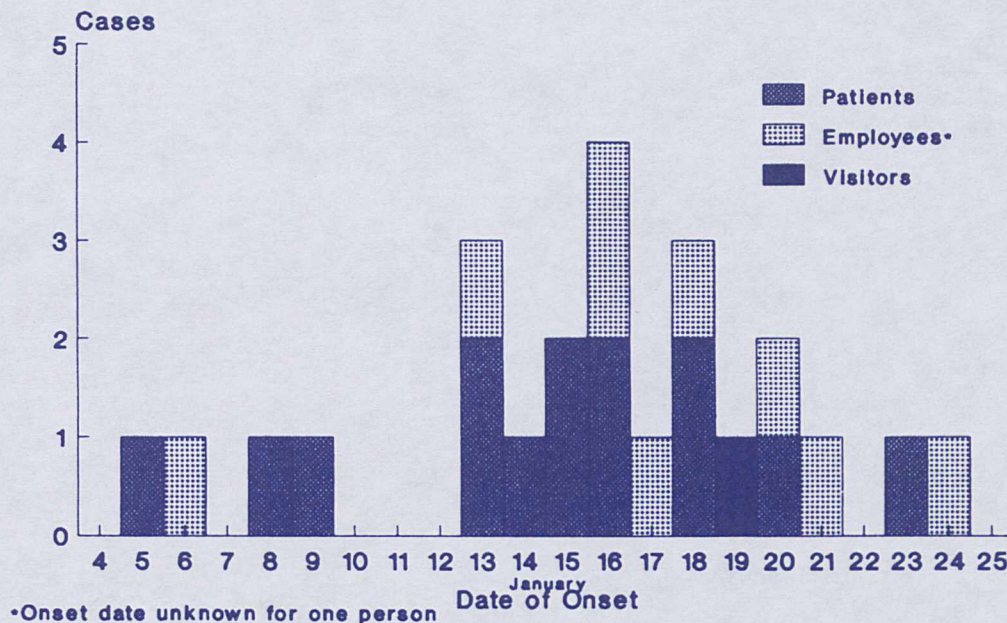


Figure 2. Diarrhea cases by date of onset, extended care unit outbreak, Florida, January 1989



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This form is to be used for:
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REQUEST FOR PRINTING SERVICES

(SEE INSTRUCTIONS ON BACK OF COPY 9)

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REQUISITION DATE: 10/1/90 2. REQUESTED DELIVERY DATE: 10/1/90 MUST

3. ORIGINATING OFFICE & DIVISION: Bldg. 1 Room 5102 MS C08 4. INFORMATION CALL: Jane Doe Ext. 1326

5. APPROVED BY: (Signature and Title) CIO Administrative Officer

6. JOB TITLE: EPI 90-01-1 Mycobacterium gordonae contamination of mycobacteria cultures 7. EXPLAIN HOW THIS MATERIAL WILL BE USED: Information for professional personnel.

8. ☒ NEW: ☒ Camera Ready Copy (CRC) Attached 11. PREVIOUS JOB No.: 12. ☐ REPRINT Original Photos Submitted

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Date(s) of Investigation _____

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Respondents (brief description)

Estimated Number of Respondents

Total Number of Responses

Frequency of Reports: ☒ Single time ☐ On Occasion ☐ Other

Man-hour Burden on Respondent (per response)

Total Annual Burden

Name of person reporting use of form _____ Date _____

65

CREW SURVEY QUESTIONNAIRE ⁽¹⁾

CDC USE ONLY
CODE = 2⁽¹⁾
ID = _____ (2-6)

Dear Crew Member:

The U.S. Public Health Service is conducting a survey of the health status of passengers on this vessel. To assist us, please answer the following questions:*

1. Name Last (7-16) First (17-24)	2. Age (25-26)	3. Sex (27) Circle one 1 Male 2 Female	4. Nationality (28-47)	5. State (48-50)
-----------------------------------	----------------	---	------------------------	------------------

6. Cabin Number (85-90)	7. Number of persons in your cabin (91-92)	8. What is your rating or occupation? (104-123)
-------------------------	--	---

9. Were you ill with vomiting or diarrhea (3 or more loose or watery bowel movements in a 24-hour period) during this cruise? ⁽¹²⁴⁾

Circle One: 1 Yes 2 No 3 Not Sure

If yes, please answer (a) through (e).

(a) Which of these symptoms did you experience? (Circle "Yes", "No", or "Not Sure" for each symptom):

	1	2	3		1	2	3
Diarrhea	Yes	No	Not sure (125)	Headache	Yes	No	Not sure (129)
Vomiting	Yes	No	Not sure (126)	Fever	Yes	No	Not sure (130)
Abdominal Cramps	Yes	No	Not sure (127)	Blood In Stools	Yes	No	Not sure (131)
Nausea	Yes	No	Not sure (128)	Sore Throat	Yes	No	Not sure (132)
				Muscle Aches	Yes	No	Not sure (133)

(b) When did your symptoms begin? (Give date and time and circle a.m. or p.m.)

Date / / (134-139) Time (140-143) a.m. p.m.
 MO DA YR

(c) Were you seen by the ship's medical staff during the cruise? ⁽¹⁴⁴⁾

Circle One: 1 Yes 2 No 3 Not Sure

(d) Are you still ill? ⁽¹⁴⁵⁾

Circle One: 1 Yes 2 No 3 Not Sure

(e) If your illness is over, how many days were you ill?

_____ Number of days ill (146-147)

10. Did you miss work because of your illness?

Circle One: 1 Yes 2 No. ⁽¹⁴⁹⁾ If Yes, how many days did you miss? _____ ⁽¹⁵⁰⁻¹⁵¹⁾

11. What is the source of the water you drink? ⁽¹⁵²⁾

Circle One: 1 Tap only 2 Bottled only 3 Both 4 Never drink water

12. If you were ill, what do you think caused it?

*PROTECTION OF PRIVACY INFORMATION

Public Law 93-579 entitled the Privacy Act of 1974 requires that individuals asked to furnish information such as that requested in this form be informed of the purpose for collecting such information and what the information will generally be used for. The following information is accordingly provided:

Authority: The Centers for Disease Control, an agency of the Department of Health and Human Services, is authorized to solicit the information requested in this form under the authority of the Public Health Service Act, Section 301, 361 (42 U.S.C. 241,264).

Purpose and Uses: The information requested will be used to implement appropriate control measures if any health problems are identified, and may be shared with federal, state and local health authorities. An accounting of such disclosures will be made available to you upon request.

Effects of Non-Disclosures: Your disclosure of the requested information is voluntary, and no penalty will be imposed if you choose not to respond. However, if you do not fill out the questionnaire, it will be more difficult for us to determine the health status of the persons on this cruise.

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
 PUBLIC HEALTH SERVICE
 CENTERS FOR DISEASE CONTROL
 ATLANTA, GEORGIA 30333**

CDC 75.12A (1. 4.410B)
 REV. 9-86

FORM APPROVED
 OMB NO. 0920-0008

PASSENGER SURVEY QUESTIONNAIRE ⁽¹⁾

CDC USE ONLY
CODE = 1 ⁽¹⁾
ID = _____ (2-6)

Dear Passenger:

The U.S. Public Health Service is conducting a survey of the health status of passengers on this vessel. To assist us, please answer the following questions:*

1. Name Last (7-16) First (17-24) _____		2. Age (25-26) _____	3. Sex (27) Circle One: 1 Male 2 Female																																																
4. Address Street _____ City _____ State _____ Zip _____ Country _____ Telephone Number: (area code) _____																																																			
5. At which port did you board the ship? (80-84) _____		10. Circle the average number of glasses of ship's water you drank per day (100-101) (If you were ill, circle the average per day before you became ill) 0 1 2 3 4 5 6 or more																																																	
6. Cabin Number (85-90) _____	7. Number of persons in your cabin (91-92) _____	11. Circle the average number of beverages containing ice you drank per day (102-103) (If you were ill, circle the average per day before you became ill) 0 1 2 3 4 5 6 or more																																																	
8. Dining Table Number (93-98) _____	9. Sitting (99) Circle One: 1st 2nd 3rd																																																		
12. Were you ill with vomiting or diarrhea (3 or more loose or watery bowel movements in a 24-hour period) during this cruise? (124) Circle One: 1 Yes 2 No 3 Not Sure If yes, please answer (a) through (f).																																																			
(a) Which of these symptoms did you experience? (Circle "Yes", "No", or "Not Sure" for each symptom): <table style="width: 100%; margin-top: 10px;"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th></th> <th>1</th> <th>2</th> <th>3</th> </tr> </thead> <tbody> <tr> <td>Diarrhea</td> <td>Yes</td> <td>No</td> <td>Not sure (125)</td> <td>Headache</td> <td>Yes</td> <td>No</td> <td>Not sure (129)</td> </tr> <tr> <td>Vomiting</td> <td>Yes</td> <td>No</td> <td>Not sure (126)</td> <td>Fever</td> <td>Yes</td> <td>No</td> <td>Not sure (130)</td> </tr> <tr> <td>Abdominal Cramps</td> <td>Yes</td> <td>No</td> <td>Not sure (127)</td> <td>Blood In Stools</td> <td>Yes</td> <td>No</td> <td>Not sure (131)</td> </tr> <tr> <td>Nausea</td> <td>Yes</td> <td>No</td> <td>Not sure (128)</td> <td>Sore Throat</td> <td>Yes</td> <td>No</td> <td>Not sure (132)</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Muscle Aches</td> <td>Yes</td> <td>No</td> <td>Not sure (133)</td> </tr> </tbody> </table>					1	2	3		1	2	3	Diarrhea	Yes	No	Not sure (125)	Headache	Yes	No	Not sure (129)	Vomiting	Yes	No	Not sure (126)	Fever	Yes	No	Not sure (130)	Abdominal Cramps	Yes	No	Not sure (127)	Blood In Stools	Yes	No	Not sure (131)	Nausea	Yes	No	Not sure (128)	Sore Throat	Yes	No	Not sure (132)					Muscle Aches	Yes	No	Not sure (133)
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(f) Were you confined to your cabin by your illness? (148) Circle One: 1 Yes 2 No 3 Not Sure																																																			
13. If you were ill, what do you think caused it? _____																																																			

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